THE RHODESIA

Agricultural Journal.

Issued by Authority of
the Minister of Agriculture and Lands.

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Leading Features.

SHEEP FARMING IN THE MELSETTER DISTRICT.

BULAWAYO MUNICIPAL EXPERIMENT STATION ANNUAL REPORT.

WITCH WEED.

MAKING A GARDEN IN RHODESIA.

SERICULTURE IN SOUTHERN RHODESIA.

GEESE.

LOCUSTS IN SOUTHERN RHODESIA.

PUBLISHED MONTHLY.

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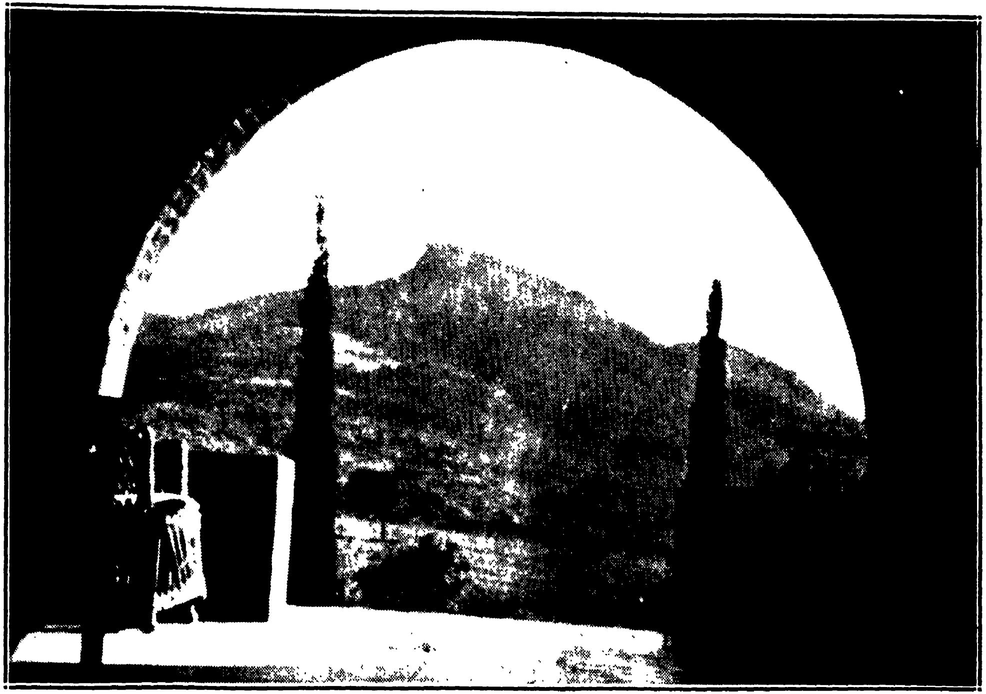

View from the stoep of the homestead at New Year's Gift, Chipinga, overlooking the tea plantation.

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Acting Editor - - *J. A. T. Walters, B.A.*

VOL. XXVIII.] JANUARY, 1931. [No. 1

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Message from the Minister of Agriculture.—The editor has asked me for a message to the farmers.

The only message I would like to send at this the closing of the old year and the beginning of the new is one of goodwill and best wishes and hope for the future.

The closing year has been one of difficulty to the farmer, and his difficulties have been very real to him; but when we take a wider survey of the situation we cannot help realising that in the economic crisis through which the world is passing our little Colony of Southern Rhodesia has been more fortunate than many other parts of the world and than many of our sister States within the Empire.

For this we have cause to be thankful, and if we read the signs aright, indications of a change for the better are not lacking.

Economists are finding that the so-called over-production in the world is more apparent than real. If the products of the world, at a fair price to the producer, were within the reach of those who are in want of them, there would be no over-production question. Want and distress exist side by side with an abundance of the products which would relieve them, but which the producer cannot sell except at a price below the cost of production. Whatever the causes for this state of affairs, a remedy must be found. The problems are world problems, and it is unthinkable that they will not ultimately be solved.

Our position in this Colony, though to us difficult enough, is infinitely simpler than the position in the older countries and the larger Dominions; but in spite of this, one thing appears certain, and that is that with the rest of the world we must make up our minds that an economic re-adjustment is necessary.

The Maize Enquiry Committee in its report has indicated that in our most important crop product there is scope for far-reaching re-adjustment. It is suggested that productivity can be increased, the cost of production lowered, the interests of the producer, consumer and distributor reconciled, and orderly marketing organised to deal with both home consumption and export overseas.

It must be admitted that all these reforms are necessary if we are to be prepared to meet the changed world conditions and if our maize farmer is to have a fair chance to make good and to keep together his home on the land.

And what is necessary and possible in the case of maize we feel is necessary, and must surely be possible, in the case of other products, whether they be agricultural products or products of animal husbandry.

The coming year promises to be an eventful one in the history of our farming industry. In some cases changes for the better may be possible at once; in others, gradual development rather than drastic change must be the policy adopted.

There is a great deal of work to be done, but if we are to make any headway at all, and if our endeavours are to be ultimately crowned with success, I would urge the necessity for all interested in the common cause working

together. There is as strong a call for harmony and co-operation among the farmers themselves as between the farming community and the Government. Ill-will and incriminating criticism are mostly senseless and groundless, and always profitless, leading nowhere. The Government and the Department of Agriculture have only one object in their relations with farmers, and that is the betterment of the farming industry and to help where help is necessary and is justified. Practical pledges of its sincerity have been given by the Government in the past and will continue to be given in the future.

With goodwill on both sides and with a full measure of co-operation among the farmers and with the Government, we need have no fear in facing the difficult but all-important problems of the coming year. That, Mr. Editor, is the message I have the privilege of sending to the farmers of Southern Rhodesia.

R. A. F.

Maize Prospects and Prices.—The following telegram has been received from the Economic Adviser (Mr. McLoughlin), who is at present in the Union:—"Position indicates smaller crop (in the Union), but shortage not anticipated. Big stocks on hand. Present prices likely to weaken." This information was received in reply to enquiries by the Chief Agriculturist as to the possible effect of the anticipated shortage in the Union crop on the policy hitherto advocated for maize growers in Rhodesia.

Rebate on Breeding Stock to the Congo.—We are advised by the General Manager of the Railways that the existing rebate on the transport by rail of breeding stock has been extended to consignments from Rhodesia to the Congo. The importance of this step will be realised when it is remembered that the number of breeding stock exported from Rhodesia to the Congo during the first nine months of 1930 amounted to 3,111. The rebate amounts to half the railage paid, and full particulars in regard to the payment

of this rebate are given in rates supplement No. 223 of the Rhodesia Railways, Limited.

During previous years the export of breeding stock to the Congo has been: 1926, 2,829 head; 1927, 1,322 head; 1928, 5,701 head; 1929, 7,293 head.

This export of breeding stock can be taken to indicate that in the future the Congo will supply an increasing proportion of its requirements from local sources. Cattle breeders in Rhodesia should bear this in mind and improve the quality of their beef cattle so as to be able to be in a position to make use of the English market if the Congo demand for beef decreases.

Rhodesian Coffee from Chipinga.—Our readers cannot have failed to observe in the daily Press of South Africa flattering references to the quality of Rhodesian coffee produced at Chipinga, South Melsetter. The correspondence on this subject supplied to us by Mr. G. Verran, of Sterkstroom, C.P., confirms this on the authority of some of the leading coffee importers of Europe. Thus the early efforts of some of the pioneers in coffee production in Chipinga, such as Mr. Swynnerton, are in measure to be crowned with a success probably greater than they ever anticipated.

The reference to Rhodesian tea in the concluding paragraph will also be read with keen interest, as this tea was exhibited and samples distributed at the Agricultural Show held in Salisbury in August last by the growers, Messrs. Ward and Phillips, of New Year's Gift, Chipinga. The correspondence is published in full elsewhere in this issue.

Winter Barley Crop, 1930.—Practically the whole of the barley crop grown in Southern Rhodesia under irrigation or on wet vleis this last winter season has been taken over by the South African Breweries at a uniform price of 20s. per bag of 153 lbs. net. In all about 5,300 bags have been received to date, while a small quantity is still expected. The chief brewer reports that the quality was satisfactory on

the whole, in some cases reaching quite a high standard. The total crop is required for malting purposes, a special malthouse having been erected at Salisbury for handling the local product.

Witch Weed Eradication.—A determined attack is being made on the witch weed pest which threatens to become a serious menace in the principal maize-growing districts of the country. At Glendale, on Mr. McCall's farm, a trial is being made with spraying mixtures which unfortunately, as at present prepared, are rather costly where extensive application would be necessary. At the Agricultural Experiment Station pot experiments are being conducted to elucidate various obscure points in the life history of the plant; while elsewhere in the country other trap crops than maize and Sudan grass are being tried. Farmers are particularly referred to the article elsewhere in this issue by Mr. Timson dealing with the measures at present recommended for the suppression of witch weed. Delay in energetically tackling this problem on individual farms can only result in an aggravation of the trouble in the future.

Decorticated Sunflower Seed.—Extract from letter written by the Director, Imperial Institute, S. Kensington, London: "It is considered doubtful whether a trade in decorticated sunflower seed could be established, since the decorticated seed is very susceptible to the air, the weather, etc., and is accordingly very liable to undergo decomposition. One firm reported that a few years ago they had a quantity of decorticated sunflower seed in store for a short time and found that it became warm and brown with unusual rapidity. The oil obtained from this seed had a high fatty acid content, and considerable difficulty was met with in its further treatment. It is feared that if sunflower seed were decorticated in the country of origin and shipped after more or less prolonged storage, it would arrive at its destination in a very inferior condition.

"It is not possible to state whether in the mill it would be more remunerative to work decorticated sunflower

seed than undecorticated seed. This question depends particularly on the comparative marketability of the cake from decorticated seed, with about 43 per cent. of protein and fat, and that from the undecorticated seed, with about 28 per cent. of protein and fat. The relative value of the rich and poor oil cakes is subject to wide fluctuations. Moreover, it must be borne in mind that the husks obtained on decortication are of little or no value."

Swedish Botanical Research Expedition.—Farmers and Rhodesians generally will learn with interest of the visit of Dr. Thore Fries, Director of the Botanical Museum of Lund, Sweden, to this country, engaged in making a comprehensive collection of our flora. The work will occupy about six months, and it is Dr. Fries' hope to cover all the typical areas of the territory. Dr. Fries' labours, when terminated, cannot fail to be of the greatest benefit in assisting to enlarge our scientific knowledge of the country and thus assist towards the solution of the various problems of a practical nature that confront us. Dr. Fries is accompanied by two assistants, and is, we know, assured of a welcome in whatever quarter of the country his labours may take him to.

Gardening in Rhodesia.—With the present issue we complete the series of articles on the making of a garden in Rhodesia by Mrs. E. M. V. Carnegie, and the whole will shortly be issued as a bulletin which can be obtained from the Department of Agriculture. No one who has read these articles can fail to be struck by their wide range and practical value. Indeed, for all but the specialist it is a complete guide to the making and maintenance of an effective farm or town garden and orchard. It has obviously been prepared by one who has had real local experience, and the article abounds with those bits of information which may make all the difference between failure and success in the handling of flowers and fruit. When it is further remembered that shrubs and trees, both ornamental and fruit-bearing, are so easily and cheaply obtained in this country, there can be no

reason why the lovers of the beautiful in their surroundings should not gratify their desires to their heart's content. The public of Rhodesia will have cause to be grateful to Mrs. Carnegie for years to come for her valuable contribution.

Map of the Vegetation Types of Southern Rhodesia.—There has recently been completed by the Division of Forestry a map defining the types of forest and tree life of Southern Rhodesia and the present limits of each area. The importance of this work can hardly be over-estimated. It is the result of years of patient survey by Mr. Henkel, and crowns his labour on behalf of forestry in our country. Anyone travelling through Rhodesia must have been struck with the great variety in vegetation from one locality to another. A careful analysis as a result of observation enabled Mr. Henkel to sift this vegetation into definite associated types and revealed the fact that these types were definitely connected with certain areas corresponding largely to climate, altitude, soil and aspect. But not to these alone, for Mr. Henkel has discovered that certain types are aggressive and will invade new areas and eventually kill out the older types. Thus is revealed a constant movement which takes place in tree life not entirely unlike the movement of invading and invaded races of mankind. An example of this is the invasion of the valuable teak country in the north-west areas by the comparatively useless msasa, resulting in the loss of hundreds of square miles of valuable teak forest. Once this fact has been established it will not be beyond man's resources to restore to the teak forests their former position of predominance, and thus maintain their utility as a source of immense revenue to mankind in perpetuity. This map will be the first, and perhaps most important step towards a complete botanical survey of Southern Rhodesia. It is hoped that the present map will be ready for publication in the near future.

Rhodesian Snakes: Nomenclature.—As a result of interest taken in the matter by Mr. H. H. D. Christian,

The Meadows, Arcturus, a list of the native names of the more common Rhodesian snakes has been furnished by the Native Department through the courtesy of Mr. Staley Jackson. In this list the Sindebele names were supplied by Mr. R. Lanning and Mr. S. W. Greer, and the Chishona names by Mr. W. Edwards.

This preliminary list is published as a matter of general interest, and when a more comprehensive list is available an attempt will be made to obtain the scientific names of the snakes, together with their habits and characteristics, more particularly as regards their being poisonous or otherwise. We invite correspondence on the subject from our subscribers.

Chishona.	Sindebele.	Common Name.
Mungu	Imamba	Black mamba.
Nyamafigo	Iloyi	Banded cobra.
Vumbge	Ibululu	Puff adder.
Chiwa	Inhlangwana	Rock adder.
Bungumrudzi	Ipimpi	African cobra.
Nyokarakuni	Inyandezulu	Boomslang.
Nyaragunguchke		Another species of boomslang.
	Inkwakwa	Lightish grey snake with ridge along back, usually found in trees.
Rovambira / Nyambobo	Mgobo	Snake with red wattles which bleats like a goat.
Ndara		File Snake.
Makure		Ring-necked cobra.
	Inhlatu	Python.
	Ivezimanzi	Water snake.
	Umhlwazi	Snake commonly called grass snake.

Dr. C. K. Brain, who, under the new scheme of re-organisation, becomes Director of Agriculture.

Re-organisation of the Department of Agriculture.

It has long been recognised that in the pursuit of research work, with which the technical officers of the Department are charged, these officers should be relieved of purely administrative work to as great an extent as possible. The new scheme of re-organisation, which has been sanctioned by the Minister of Agriculture, and which is shortly to come into existence, marks a great step forward towards the realisation of this ideal. By its provisions the technical officers of the Department will be almost entirely free to devote their energies purely to the work for which they are specially fitted, and to give their attention in greater measure than ever before to establishing close contact with the farming community, individually and collectively, in the solution of the problems with which they are faced.

There is another aspect of the work which devolves on the technical expert to which attention has been given in this scheme, and that is the necessity for *team work*, which is nowadays rightly regarded as essential for expeditious progress along any line of research. It has been notorious in the past that brilliant work by an individual working in isolation has remained ineffective, sometimes for decades, the most glaring case being that of Gregor Mendel, whose researches to-day form the basis of almost all modern work in the realm of heredity, but whose work was unrecognised for nearly fifty years after his death. The present re-arrangement will enable workers in related spheres to combine under a common head, and this combination cannot but result in the quicker achievement of the ends which each has in view.

The scheme provides for the control and co-ordination of the work of the entire technical and professional staff in the hands of a Director of Agriculture, who will be free to devote the whole of his time to this end. He will be primarily responsible to the Minister for the proper correlation of the professional work of the senior divisions and

branches, the conduct of the *Rhodesia Agricultural Journal* and all matters which require professional and technical consideration. To this post Dr. C. K. Brain, the present Acting Secretary, has been appointed.

The entire administrative work will be placed in the hands of a Secretary for the Department of Agriculture, who will be responsible to the Minister for all branches of the Department and will be solely responsible for all matters relating to finance, staff, discipline and general organisation; and the heads of all divisions and independent branches will communicate direct with him on all matters other than those involving professional or technical direction, and this post will be filled by Mr. A. C. Bagshawe, for so long a time Secretary to the Department of Mines and Public Works.

The various branches of the Department, which up to the present have functioned as separate units, will be grouped with those with which they have an affinity into divisions for the better promotion of their common interests, each division being under a controlling chief of that division. The principal divisions will be four in number, as follows:—

1. *Division of Animal Industry*, comprising all veterinary services, as well as the branch of Animal Husbandry. The post of chief of this division will be filled by Mr. J. M. Sinclair, with Dr. A. E. Romyn as Senior Animal Husbandry Officer. The dairy and poultry branches will be comprised under this division. The sub-division of veterinary research will remain a separate branch for the time being, under the Director of Veterinary Research, Mr. Ll. E. W. Bevan.

2. *Division of Plant Industry*.—This will include the present branches of the Chief Agriculturist, Plant Pathologist, Botanist, Tobacco Adviser and Fruit Adviser, and will control the work on the various experiment stations throughout the country. This post will be held by Mr. H. G. Mundy, in addition to his present post of Chief Agriculturist.

3. *Division of Forestry*, under the Chief Forest Officer, whose duties will also comprise those of game preservation.

4. *Division of Irrigation* (including agricultural engineering, boring and meteorology), under the present chief, Mr. C. L. Robertson.

Mr. J. S. Henkel, F.R.S. (S.Af.),
who retires from the post of Chief Forest Officer.

In addition to these main divisions it is proposed for the present to retain as separate branches those of Entomology—which is also responsible for tsetse fly investigation and for the plant regulations—and of Chemistry, responsible for the chemical aspect of pasture research and the administration of the Acts relating to farm foods and fertilisers. The officials in charge of these branches will be under the same general control as the chiefs of divisions, and will use the same channels of communication.

The Retirement of Mr. J. S. Henkel.

On the 27th June next Mr. J. S. Henkel will retire from the Forest Service of this Colony on reaching the age of 60. He is at present on leave, and his service actually terminates at the end of December, 1930.

During the last eleven years Mr. Henkel has made a host of friends in all parts of the country, and his retirement will be regretted by many. His absence from office will cause a gap in the ranks of the Department of Agriculture, of which every member will miss a most enthusiastic, hard-working and loyal colleague.

Mr. Henkel's association with forestry dates back to July, 1888—rather more than 42 years—when he joined the Cape Service as a probationer at Kingwilliamstown. Nearly five years later he was appointed as district forest officer, and worked for eight years in that capacity at Kingwilliamstown and Stutterheim.

In 1902 Mr. Henkel was selected by the Cape Government to proceed to the Royal Indian Engineering College, Cooper's Hill, for a scientific course in forestry. This was the premier forestry training centre in Britain at the time, and the course included one year's study on the Continent. During this course—both in England and Germany—Mr. Henkel was recognised as the outstanding student of the class for his keen powers of observation and deduction, and

his extraordinary vision was always focussed on the practical rather than the theoretical or purely academic future.

I understand that Mr. Henkel is one of the two students only who passed through this college with 100 per cent. marks for the practical course on the Continent.

Perhaps the most striking example of this was the case of certain caterpillar pests on the pine trees in Germany, when Mr. Henkel's enquiry established the relationship between this pest and certain small birds. The remedy was obvious, and what is of more importance, Mr. Henkel's recommendations were immediately brought into force, and have remained the standard routine since that date.

Mr. Henkel obtained the Diploma of Forestry in 1905, and returned to Kingwilliamstown as Assistant Conservator of Forests.

After his return he re-organised the whole forest service of the Cape Colony, and his scheme of re-organisation was extended later to the whole Union. He was appointed chairman of the Forestry Board at the South African College, and was the principal lecturer in forestry at that institution.

During the succeeding years, until his transfer to the Rhodesian Service on the 1st January, 1920, Mr. Henkel was in charge of all forestry work—first in the Capetown area till 1909, then in Knysna to 1914, and finally in Natal.

Since coming to Rhodesia Mr. Henkel has laid the foundation on which the Forestry Service of this Colony will be built.

The Mtao station was established in 1922. The policy for the protection of our valuable indigenous forests on the Kalahari sands was laid down in 1925, and the Stapleford station came into being in 1928. Over a million trees are being planted annually, and the wonderful financial asset which will undoubtedly accrue from this work will only be appreciated when the results of Mr. Henkel's foresight, organising ability and industry are finally reaped.

In addition to organising the Forestry Service, Mr. Henkel has found time to do a considerable amount of lecturing to farmers, and has stimulated interest in the planting of trees on farms and around schools, and the plantations scattered over the country indicate the success with which this work was done.

In 1928, as president of the botanical section of the South African Association for the Advancement of Science, Mr. Henkel submitted a paper on the "Relation of the Vegetation to the Water Supply of Southern Rhodesia." At this meeting a resolution was passed requesting this Government to allow Mr. Henkel to prepare a map which would embody the results of his observations as outlined in his paper. The Government has given Mr. Henkel every facility to carry out this work, and he has steadily collected data which have enabled him—as his final work in this Service—to produce a map which shows clearly the main distribution of the different tree types. It is believed that this map is the only one of its kind for any territory in Africa. It will form a most valuable basis for future observation on the trees of the Colony, and also for a complete biological survey as soon as workers are found to undertake such a study. The writer has had the pleasure of accompanying Mr. Henkel on several trips during which he was checking his notes on the distribution of the trees, and has also seen his carefully detailed field notebooks, which number fifty or more. The making of the thousands of records and the compilation of the map from these notes was an enormous task which in itself would establish Mr. Henkel as a leader in forest matters in Africa.

During the last year the forestry branch has been made responsible for all game preservation in the country, and the mapping of the Wankie game reserve by Mr. Henkel ranks second only to his tree map.

Mr. Henkel's most valuable characteristics have always been his boundless energy and enthusiasm. One might imagine that in his early youth he became imbued with the spirit of one of the forest trees he loves so well. Throughout the years he has maintained these characteristics in ever-increasing intensity, and one could not wish Mr. Henkel any greater blessing than that he should continue to maintain them for many years to come.

Mr. Henkel intends to take up private practice in Natal, and we are sure that all his friends will wish him the greatest success and happiness in his new sphere.

C. K. B.

Bulawayo Municipal Experiment Station.

REPORT FOR THE SEASON 1929-30.

By S. D. Timson, M.C., Dip.Agric. (Wye),
Assistant Agriculturist.

This station has now completed its ninth year of demonstration and experiment work, carried on by means of co-operation between the Bulawayo Municipal Council and the Department of Agriculture.

The results obtained throughout this period are of the first importance to farmers of Matabeleland, though it is to be feared that the majority do not yet fully appreciate this, or utilise to the full the knowledge gained, in their own farming operations. This is a matter greatly to be regretted, and seems largely due to the fact that a number of the farmers persist in the mistaken idea that the size of the plots on which this experimental work has been carried out (one-quarter to one acre) is not great enough to give practical results which may be followed by the farmer on his own land. As convincing evidence that this is incorrect, it may be pointed out that at Rothamsted the leading authorities on field crops experimental work for the most part utilise plots of no greater size than one-twentieth to one-fortieth of an acre, and many of the field experiments are carried out on plots as small as one-eightieth of an acre. A new series of rotation experiments are now being laid down there on plots one-fortieth of an acre in size.

Sir A. D. Hall, formerly Director of Rothamsted Experiment Station, in discussing this question in his book, "The Soil," states: "Speaking generally, it may be said that

with due care a plot one-twentieth of an acre can be made to answer all ordinary purposes."

The points of primary importance to the farmers of Matabeleland, which have been demonstrated on the Bulawayo station during the period 1921 to 1929, have been reviewed in Bulletins Nos. 675 and 773, the annual reports for the year 1926-27 and for the years 1927-28 and 1928-29. These reports should therefore be read in conjunction with the present review.

Great credit is due to Mr. Dunn, the Commonage Ranger, who now has the experiment station under his charge, for the thorough way in which the work has been carried out during the past two years. If the low total rainfall for the season and the unfavourable way in which it was spread over the growing period are considered, the crop yields obtained during the current year are remarkably good. There were two considerable periods of complete drought during the growing season—one of 26 days, from the 22nd December to the 16th January, and the other of 25 days (.07 in. of rain fell on the 12th February), from the 27th January to the 20th February.

New experiments being commenced this season, 1930-31, are as follows:—

1. Liming trials with maize.
2. Comparison of the efficacy of applications of phosphatic fertiliser to (a) green manure crops, (b) the maize crop following green manure crops ploughed under.
3. Comparison of dolichos beans with Soya beans as a hay crop, the Soya beans being inoculated.
4. Rate of application of fertiliser to the maize crop.
5. Hull-less oats and summer wheat as poultry feeds.

ANALYSIS OF RAINFALL, SEASON 1929-30, AND FOR PREVIOUS EIGHT YEARS.

The following tables give the distribution of the rainfall for the season 1929-30 and for the previous eight years:—

1929-30.

Month.	No. of days on which rain fell.	Total for month, in inches.	No. of rains exceeding ¼ inch.	Total to end of month, in inches.
October	2	0.12	0	0.12
November	8	3.97	6	4.09
December	10	3.86	4	7.95
January	6	5.02	4	12.97
February	4	0.57	1	13.54
March	6	1.97	3	15.51
April	7	2.48	2	17.99
Totals	43	17.99	20	17.99

Averages for last Nine Years, Seasons 1921-30. (In inches.)

Year.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April.	May.	Total.
1921-22	nil	0.68	4.87	5.03	0.88	0.69	0.33	nil	nil	12.48
1922-23	,,	1.65	1.97	3.75	6.69	8.76	10.40	,,	,,	33.22
1923-24	,,	nil	3.00	1.20	4.17	4.18	2.70	,,	,,	15.25
1924-25	,,	0.79	5.15	10.11	5.09	6.95	9.91	3.66	3.41	45.07
1925-26	,,	nil	0.53	0.97	3.78	5.49	10.77	nil	nil	21.54
1926-27	,,	,,	1.27	4.33	2.61	4.44	0.44	,,	,,	13.09
1927-28	,,	1.84	1.50	4.22	5.58	0.77	0.64	0.07	,,	14.62
1928-29	0.89	nil	3.09	6.74	8.81	6.47	7.46	0.02	0.18	33.66
1929-30	nil	0.12	3.97	3.86	5.02	0.57	1.97	2.48	nil	17.99
Average	0.09	0.56	2.81	4.46	4.72	4.25	4.95	0.69	0.39	22.99

ROTATION EXPERIMENTS.

Rotation A.

Maize Yields in Bags of 203 lbs.

Crop and treatment.	Yield per acre, 1929-30.	Average yield per acre to date.
Maize plus 7 tons farm manure per acre (after Sudan grass)	7.15	11.56 (7 years)
Velvet beans	21,700 lbs. green fodder	12,544 lbs. (7 years)
Maize plus 200 lbs superphosphate per acre (after velvet beans reaped)	8.30	10.35 (7 years)
Sudan grass—	green fodder	
First cutting	8,968 lbs.	8,978 lbs. (7 years)
Second cutting	3,056 lbs.	2,842 lbs. (4 years)
Third cutting	...	1,050 lbs. (1 year)

Maize planted 7.12.29, velvet beans 28.11.29, Sudan grass 7.12.29.

The rotation consists of first year maize with seven tons (approximately) kraal manure per acre, second year velvet beans reaped for hay or green fodder, third year maize plus phosphatic fertiliser, fourth year Sudan grass for hay.

N.B.—In 1926, 1928 and 1929 Sudan grass gave only one cutting, the aftermath being grazed off.

Rotation B.

Maize Yields in Bags of 203 lbs.

Crop and treatment.	Yield per acre, 1929-30.	Average yield per acre to date.
Maize plus 200 lbs. superphosphate per acre (after velvet beans ploughed in)	6 92	12.21 (7 years)
Velvet beans ploughed in ...	...	...
Maize plus 200 lbs. superphosphate per acre (after oat stubble)	6.90	10.02 (7 years)
Oats	460 lbs. grain	741 lbs. grain (7 years)

Maize planted 7.12.29, oats 18.12.29, velvet beans 28.11.29.

N.B.—During years 1921 to 1926 the maize after oats received no fertiliser, and during the three years 1927 to 1929 it received 100 lbs. per acre only of superphosphates.

Maize Continuous.

Maize Yields in Bags of 203 lbs.

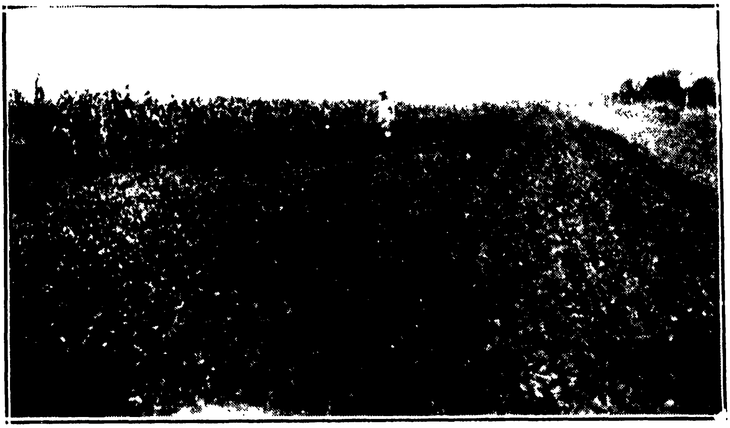
Crop and treatment.	Yield per acre, 1929-30.	Average yield per acre to date.
Maize continuous without treatment ...	1.42	4.87 (7 years)
Maize continuous plus 160 lbs. per acre of bone and superphosphate every alternate year, 1924-25, 1925-26 (by error), 1927-28 and 1929-30	6.6	8.47 (7 years)

Maize planted 7.12.29.

Probably the most important fact which these rotations have established up to date is that a leguminous green manure crop ploughed under once in four years, combined with light dressings of phosphatic fertiliser twice in the four years, has maintained the soil fertility at as high a level as a dressing of seven tons per acre of farm manure and one light dressing of phosphatic fertiliser in the four-year period. This is a matter of the greatest importance in this Colony, where the amount of farm manure available for manuring the land, compared with the large acreage under crops, is almost negligible on the average farm.

Another point of great importance demonstrated by these trials is that soil which is cropped continuously to maize without the application of fertiliser rapidly falls in fertility to a low and quite unremunerative level. In the year under review the plot which has grown maize continuously yielded only 1.4 bags of maize per acre, whilst the average yield of maize on the four plots in Rotations A and B was 7.1 bags per acre—that is, five times as great. The average yield on the plot where maize has been grown continuously for nine years without fertiliser or manure is 4.8 bags per acre, whereas the average yield on the four plots in the two Rotations A and B for the period of seven years is 11 bags per acre. The plot on which maize has been grown continuously for nine years, and which has received a dressing of 160 lbs. per acre every other year since the season 1924-25, has given an average yield of 8.4 bags of maize per acre, compared again with an average of 11 bags an acre in the rotation plots.

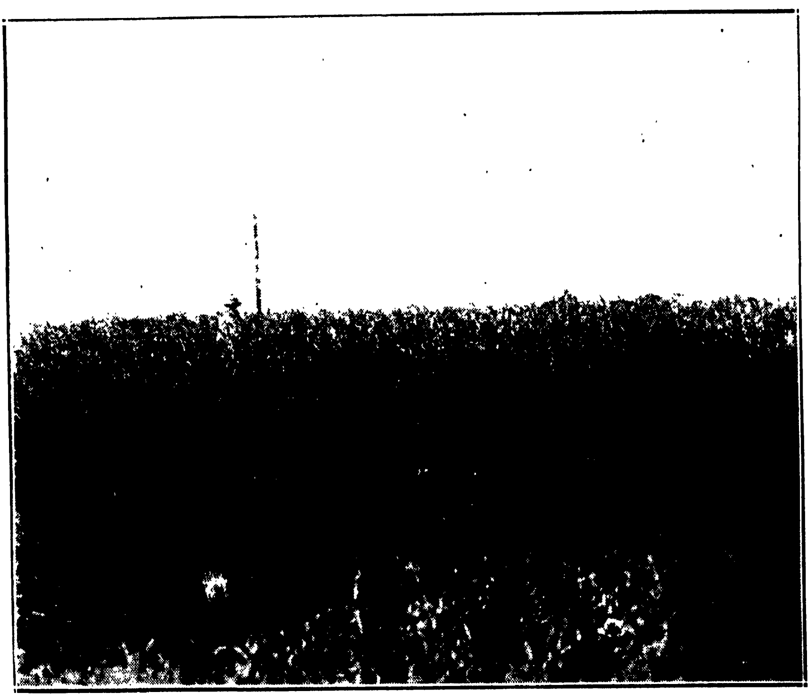
The efficacy of a rotation of crops which maintains the humus supply of the soil, combined with light dressings of phosphatic fertiliser once or twice in the four-year period.



Ground nut variety trials. Spanish Bunch in foreground; Virginia Bunch in background. Spanish Bunch yielded 18.3 bags and Virginia Bunch 23.1 bags per acre.

Soya beans; variety trials. Highest yield, 487 lbs. beans per acre.

Catch crop of buckwheat. Can be planted late if the main crops fail.



Sudan grass in Rotation Series No. 1. Green yield per acre: first cutting, 8,968 lbs.; second cutting, 3,056 lbs.

in maintaining fertility, is very well demonstrated by these rotation trials, which support the results obtained in similar trials conducted on the other experiment stations at Gwelo and Salisbury.

Comparison of the Effect on the Maize Crop of Applying the Fertiliser to the Maize Crop Direct

As against Applying it to the Preceding Legume Crop, which is Reaped for Hay.

Formerly Rotation Series C and D, now called Systems E and F respectively.

In 1928-29 the design of these rotations was altered so that on plot 23b to plot 25a the phosphatic fertiliser is applied to the leguminous hay crops (velvet beans and cowpeas) preceding the maize crops. On plots 27a to 27d the fertiliser is applied direct to the maize crop.

Yields of Maize in Bags per Acre.

Treatment.	1928-29	1929-30	Yields of legume hay in lbs. per acre.			
			1928-29		1929-30	
			Velvet beans.	Cow-peas.	Velvet beans.	Cow-peas.
200 lbs. per acre superphosphate applied direct to maize	12.7 (2 plots)	5.3 (2 plots)	38,040	8,804	20,640	8,464
Fertiliser applied to preceding legume hay crop	9.7 (2 plots)	8.6 (2 plots)	33,240	9,362	12,772	12,710

This experiment has not been carried on for a sufficient number of years to give significant results on which reliance can be placed; nevertheless it is very interesting to note that in 1928-29, the first year of the commencement of the experiment, the yield of maize is 3 bags per acre greater on the plots on which the fertiliser was applied direct to the maize, whereas in the following year almost the reverse is the case, the maize following the fertilised legume hay crop yielding almost three bags per acre more than the maize receiving the direct application of fertiliser. The result is all the more

remarkable in that the soil of the System F plots is better and more fertile than that of the System E plots, which is very gravelly and shallow, and this is well exemplified by the yields shown in the above table in the year 1928-29. Furthermore, the System E plots have received 360 lbs. of bone and superphosphate per acre and 400 lbs. of superphosphate per acre on half the area of the plots during the years 1924 to 1927.

MAIZE VARIETY TRIALS.

These variety trials have been discontinued, as it is considered that they have now served their purpose. The trials have demonstrated that our four local long-season white dent varieties, over a period of years, will give considerably heavier yields of grain per acre than the yellow or flint varieties commonly grown in Southern Africa.

Some eighteen different varieties of maize have been under trial, and the majority have been rejected on account of low yields and susceptibility to maize blight.

The yield of the four local varieties of flat white maize is practically the same. This confirms the results obtained at the Salisbury Experiment Station over a longer period of years. The following table gives the results of the variety trials:—

Average of Duplicate Plots each Year.

Variety.	Average yield per acre in bags of 203 lbs. over 7 years.
Louisiana Hickory	8.80
Potchefstroom Pearl	8.48
Hickory King	8.45
Salisbury White	8.40
Yellow Flint	6.64
American White Flint	6.33 (4 years)
Sahara Yellow	6.9 (2 years)
Golden Beauty	6.8 (2 years)

Other varieties which have been tried and discarded for various reasons are Krug Corn, Wisconsin White Dent, Iowa Silver Mine, Eureka, Texas Hickory, Menne, German Yellow, Yellow Cango, Pride of Saline, Minnesota No. 133.

The reader is referred to Bulletin No. 773, published in the February issue of the *Rhodesia Agricultural Journal*, for more complete criticism of these trials.

GROUND NUT VARIETY TRIALS.

The results of these trials to date are shown in the following table:—

	Yield per acre (bags of 75 lbs.), 1929-30.	Average yield per acre to date (bags of 75 lbs.)
Spanish Bunch	18.5	18.0 (3 years)
Virginia Bunch	23.1	14.0 (3 years)
Virginia Runner	—	14.1 (1 year)
Japanese Bunch	—	12.8 (1 year)
Jumbo	—	7.2 (1 year)

This year the Virginia Bunch variety has shown the superiority in yield which it has displayed consistently at the Salisbury Experiment Station. This is undoubtedly due to the fact that on this occasion this variety was planted sufficiently early. In the past it has been planted too late, namely, in the first or second week in January.

Virginia Bunch requires a two to three weeks' longer growing season than the Spanish Bunch variety, and so should be sown in the first half of December. If it is not possible to plant ground nuts until the beginning of January, then the better variety to use is the Spanish Bunch. But where the crop can be planted in mid-December it is probable that the Virginia Bunch will give considerably heavier yields of both nuts and hay and a greater yield of protein per acre. The nuts of the Virginia variety are larger than those of the Spanish variety, and this will tend to reduce the cost of hand sorting—a matter of some importance where the nuts are being exported overseas. The larger nut will also be more likely to fetch a satisfactory price in the confectionery trade.

Planting Distances of Ground Nuts.—It has been proved by experiments carried out here and at other experiment stations in the Colony that the best planting distances for this crop are approximately 18 ins. x 6 ins. This can be done only where hand weeding is possible. Where machine cultivation must be employed, the crop should be planted 24 to 26 ins. between the rows and as near as possible to 6 to 8 ins. between plants.

SILAGE AND FODDER CROPS.

Yields per Acre in lbs. (Green Fodder).

Crop	How sown	1929-30	Average yield to date	Period, in years.
Sunflower and velvet beans	36 x 9 (same rows)	31,496	19,178	7
Sunflower and velvet beans	20 x 18 (alternate rows)	...	16,339	4
Sunflower alone ...	30 x 12 ...	26,124	20,394	7
Maize and velvet beans	36 x 9 (same rows)	17,608	13,202	7
Maize and velvet beans	20 x 18 (alternate rows)	...	13,570	4
Maize alone ...	30 x 12	16,120	14,407	7
Kaffir corn and velvet beans	36 x 9 (same rows)	...	8,721	3
Kaffir corn and velvet beans ...	20 x 9 (alternate rows)	...	14,216	3
Kaffir corn alone ...	24 x 9 ...	19,688	12,168	6
Maize and cowpeas ...	36 x 9 (same rows)	...	12,772	1
Kinvarra oats and Soya beans	Broadcast ...	...	8,400	1
Kinvarra oats and wedge peas	Broadcast ...	...	8,400	1

These crops were all planted on the 23rd December, 1929. The five silage crops grown this year were planted on the 23rd December, and no rain fell from the 21st December until the 17th January, and a further drought occurred between the 26th January and 20th February. The land on which these crops were grown from the year 1921 to 1928 has grown silage crops continuously, and during that period has received only six tons of kraal manure per acre (in 1926-27) and 100 lbs. of superphosphate per acre in 1928-29. The yields per acre during the past season speak for themselves.

The trials with these crops, having achieved their purpose in demonstrating the excellent yields which can be obtained in Matabeleland, at small cost, over a period of years and under varying conditions of climate, will now be discontinued.

It may be well to point out that the average total yearly rainfall for the period covered by these trials is only 20.53 inches.

CROPS FOR HAY OR SILAGE.

Yields of Green Fodder in lbs. per Acre.

Crop.	1929-30.	Average yield.	Period, in years.
Velvet beans	17,188 (4 plots)	11,331	6
Dolichos beans	11,160	11,330	6
Cowpeas (common iron)	12,746 (3 plots)	8,265	5
Sudan grass	12,024	6,900	5

The above legume crops and Sudan grass again demonstrated their wonderful drought-resistant properties. Despite two complete drought periods of 26 days and 25 days during the growing period, the former occurring immediately after planting, these crops produced excellent yields. Over a period of nine years they have proved themselves reliable hay crops, admirably suited to conditions in Matabeleland. Although Sudan grass is a non-legume and does not yield as heavily as the three legumes, yet it has one great advantage over them as a hay crop, namely, that it is upright in growth and can be handled by ordinary hay-making machinery; while further, it normally provides a valuable aftermath after the final cutting, which can be utilised for grazing by sheep or cattle.

COMPARATIVE TRIAL OF LEGUMES FOR HAY.

Yields per Acre in lbs. (Green Weight.)

Crop.	1929-30.
Cowpeas	17,064
Velvet beans	13,640
Dolichos beans	11,160

The plots on which this trial was carried out had been cropped continuously since the opening of the station in 1921—that is, for a period of eight years. During this period the plots had received only a dressing of six tons per acre of kraal manure in 1926-27 and 200 lbs. of superphosphate per acre in 1927-28.

The soil on these plots is very shallow, not exceeding 9 ins. in depth; and considering the above conditions, and the low rainfall and two severe droughts, the yields obtained are excellent and once again serve to demonstrate the value of these crops under Matabeleland conditions.

LEGUMES FOR GRAIN.

Yields in lbs. per Acre.

Variety.	Season 1929-30.	Average yield to date.	Period, in years.
Velvet Beans—			
White Stingless	824	824	6
Tracey's Early Black	620	524	2
Osceola	691	462	2
Somerset	279	279	1
Variety 30/26	359	359	1
Florida	—	525	3
S. taborense	—	375	1
Dolichos Beans—			
Small brown seeded ...	1,007	530	6
White seeded	—	84	1
Indian	737	737	1
Ewanrigg	186	186	1
Tepary beans	560	281	4
Kaffir bean or pea	—	506	2
Cowpeas—			
New Era	743	715	3
Common Iron	759	711	6
Whip-poor-will	591	477	6
Upright Iron	—	150	1
Victor	—	105	1
Brabham	255	240	2
Monetta	347	213	2
Gwelo Exp. Stn.	—	713	1
Dhal	624	395	4
Sunn hemp	633	517	7
Chick pea or gram	328	328	1
Canadian wedge pea	368	422	2
White Jack bean	961	961	1
Soya Beans—			
Oo-too-tan	460	460	1
Herman	487	487	1
Biloxi	289	289	1
Chinese	345	345	1
Laredo	—	384	1

The above table of yields of grain of thirty different varieties of legumes gives a good idea of the great variety

of crops which can be grown in this Colony, though not all of those shown in this table could be recommended for general use. For the dairy or mixed farmer who wishes to grow his own concentrates, containing a high percentage of protein, the following crops can be recommended under normal conditions:—White stingless velvet beans, small brown seeded dolichos beans, kaffir beans, Common Iron and New Era cowpeas, White Jack beans and Oo-too-tan and Herman Soya beans. The Soya bean is only recommended if the seed or the soil is inoculated with the proper bacteria before planting, and if there is an ample supply of humus in the land.

Of the remaining varieties, some have special uses, such as the Canadian wedge pea, which is an excellent palatable substitute for the ordinary table pea, and can be grown in summer as a field crop.

Tepary beans are valuable as a catch crop, owing to the shortness of the growing season required. They also grow better on raw soil than most crops, and are extremely drought resistant.

The White Jack bean, besides its usefulness as a silage crop and green manure, is said by M. P. de Sornay ("Green Manures and Manuring in the Tropics") to be a delicious table vegetable, the pods being cooked when still in the green stage.

POTATOES.

Yields in Bags of 150 lbs. each per Acre.

Treatment.	Season. 1927-28.	1928-29.	1929-30.
No treatment	26.4	—	—
200 lbs. double complete potato fertiliser per acre	—	46.3	—
200 lbs. double complete potato fertiliser and 10 tons farm manure per acre	—	73.7	—
200 lbs. superphosphate per acre	—	—	14.8
200 lbs. bone and superphosphate per acre ...	—	—	8.4
10 tons farm manure per acre	—	—	8.5

The results shown in 1928-29 in the above table are the average yields of duplicate plots, and exemplify the need of this crop for an ample supply of humus in the soil. The plots on which the crop was grown in that season had been under crop since 1921-22, and had received no addition of humus to the land during that period.

The results recorded for the year 1929-30 cannot be considered significant on account of the "seed" used being variable and poor and on account of the long dry spells from which the crop suffered.

In 1928-29 the highest yield obtained was 81.4 bags per acre from one of the plots receiving the dressing of farm manure, in addition to the complete fertiliser.

SWEET POTATOES.

Grown from Tubers left in the previous Year.

	Yield, season 1929 30, in lbs. per acre		Average yield over 6 years in lbs. per acre.	
Variety.	Tubers.	Green tops.	Tubers. 5 years only.	Green tops.
Calabash Leaf ...	—	2,080	9,356	16,765
Early Butter ...	—	2,672	13,514	12,343

Grown from Cuttings (planted and cut same Season).

1925-26.

Variety.	Average yield per acre (4 years)
Calabash Leaf	7,996
Early Butter	5,832

Sweet potatoes are a valuable winter stock feed, and every farmer would be well advised to have a few acres under this crop. It is probable that the best way to grow it in Matabeleland is to establish it under the maize crop each year by planting cuttings between the rows at the last cultivation of the maize in January or February. The crop then becomes established that year, and in the following year makes early growth, and by the end of the season the tubers may be lifted as required. This method of handling the crop may be relied upon to give much greater yields of tubers than where the crop is lifted the same season as it is planted, and does not reduce the yield of maize.

White Jack bean (*Canavalia gladiata*). Yielded 961 lbs. of seed per acre.

Dolichos beans; variety trials. Highest yield of seed, 1,007 lbs. per acre.

Sheep Farming in the Melsetter District.

By J. C. Kruger,
Part-time Sheep Adviser in the Melsetter District.

The district of Melsetter is an oblong strip consisting of undulating and mountainous, well watered country, commencing 40 miles south of Umtali, extending in a southerly direction to the boundary of Portuguese East Africa, a distance of approximately 140 miles. The Sabi River forms the western boundary, and on the east the district is separated from Portuguese territory by the Chimanimani Mountains for a distance of about 60 miles to a point on the Rusiti River. From here the boundary is all along the eastern border in a southerly direction until it joins up with the Sabi River. From east to west the width is approximately 80 miles as the crow flies. The altitude varies from 6,000 feet on the high veld to 2,000 feet in the Sabi Valley. There are no extremes of climate, and the conditions may be described as ideal throughout the year. The normal rainfall is 44 inches. The rainy season commences in October and ends in April. Winter rains and Scotch mists during some years are experienced on the high veld areas. The prevailing winds are from the east and south-east. The administrative headquarters of the district is the village of Melsetter, which is centrally situated between Mid and North Melsetter. The nearest railhead is Umtali, 90 miles away.

Chipinga, situated 46 miles south of Melsetter, is connected with Umtali by the Sabi road, a distance of about 120 miles. The district is served with a bi-weekly service of railway motor lorries from Umtali.

Melsetter as a Sheep Farming District.—The parts of Melsetter suitable for sheep farming are:—

North Melsetter.—A narrow strip starting from a point in the most northerly part of the district all along the Portuguese border to where it joins up with the Chimanimani Mountains, embracing about 20 farms.

Mid Melsetter.—About two-thirds of the area within a radius of about 20 miles from Melsetter.

The High Veld.—The entire area known as the Melsetter high veld, comprising some 20 farms.

Chipinga (South Melsetter).—Approximately one half of the total area, which includes the whole area known as the eastern border, and all farms in the vicinity of the Chipinga township; *excluding* all farms 20 miles south-east and 10 miles south-west of Chipinga, embracing the whole Sabi Valley, which is unsuitable for sheep.

McTamibara Flats.—The McTamibara Flats, situated in the north-western part of the district, comprise about a dozen farms. At present there is only one small flock of sheep here and the conditions are not too promising. This area cannot be recommended for sheep, as the country here is too level and consequently becomes swampy in parts during the rainy season.

Taking the Melsetter district as a whole, there are approximately 70 farms of 1,500 morgen each suitable for sheep. This gives a total of approximately 100,000 morgen of sheep veld. With an average carrying capacity of two sheep to the morgen, this means that there is veld available for 200,000 sheep, and the price of farms suitable for sheep is from 20s. to 40s. a morgen.

Brief History of Sheep Farming.—About 25 years ago sheep farming was started on a few farms. Old residents state that the undertaking was most successful in the beginning up till 1915, when trouble arose from every direction in the shape of blue tongue, scab and parasites. In a few years' time flocks numbering from 1,500 to 2,000 were reduced to much below the four figures. Another great setback occurred in the rainy season of 1917-18, when the rainfall registered over 100 inches. This was the heaviest fall ever recorded in this district.

From 1918 to 1925 there was a steady falling off both in numbers and condition of the few flocks which still existed,

and at the beginning of 1926 it looked as if sheep farming had come to the end of its days. This was the time when the writer arrived in the district, and on going round to buy a few hundred ewes he was asked by some owners if he would not take the whole lot, as they were fed up with sheep farming. During that and previous years lots of young breeding ewes were sold to butchers in Umtali. The opinion then about sheep farming was most discouraging, some people (especially those who had never tried sheep farming before) being against another attempt to foster the industry. During all these years there still remained a few who would not accept defeat, and to them the gratitude of the whose district is due for their courage and endurance.

Most of the setbacks and failures in the past can be attributed to ignorance of methods of disease control. Being situated 1,000 miles from the nearest sheep districts in the south and with poor means of communication, farmers were unacquainted with the latest methods and remedies. Blue tongue, scab and worm parasites played havoc amongst the few flocks during those years.

The system of kraaling also had very detrimental effects, as during the rainy season it was impossible to keep the kraals dry and clean.

From 1926 to 1928 there was a marked improvement in most flocks, as better methods were then applied on some farms, which were soon followed up by other farmers; also a ready use was then made of blue tongue vaccination and wireworm remedies.

Government Experiment Flocks.—During 1926 the Government was persuaded to try a few experimental flocks in different parts of Southern Rhodesia. Four flocks imported from the Union of South Africa were distributed in various parts of the Colony, and one consisting of 200 ewes arrived on the farm Cecilton, in this district, during the latter part of 1926. These sheep were imported from the Boshof and Hoopstad districts of the Orange Free State. The first rainy season, which was below normal, caused a severe setback amongst the flock, and during all the following rainy seasons the detrimental effects could be noticed.

A mistake was made in importing these sheep from the south-western Free State, which consists of Karroo and semi-Karroo veld, with a rainfall of about 12 inches, as it was then known that sheep from Karroo veld, with a low rainfall, would not thrive under local conditions. However, under good management this flock is still in existence and has increased to approximately 500. They were favourably commented upon by Mr. E. N. S. Warren, Acting Chief Sheep and Wool Officer of the Union, on his recent tour of Southern Rhodesia to investigate and report on the possibilities of sheep farming.

During 1928 another flock of 150 ewes was imported from the Boshof district of the Orange Free State. They arrived in the district in very poor condition, being grossly infested with all kinds of worm parasites.

On account of their poor condition, it was not advisable to inoculate them for blue tongue on arrival in October. In November the rainy season started in earnest; nothing could then be done to save them, and they died by the dozen from blue tongue and other causes. Only about 30 survived. This should serve as a warning in future not to import diseased sheep late in the year.

From 1928 more confidence has been manifested, as from then onwards several flocks of Merinos were imported from the Union, mostly from Natal and the high veld areas of the Transvaal. The first flocks from the Bethal district, Transvaal, consisted of 130 ewes. These now number between 500 and 600, and they have so far proved a wonderful success. Later importations from those areas have practically all turned out successful.

In two instances of importations numbering 200, 50 died from different causes within three weeks after being off-loaded at Umtali.

From the beginning of 1927 up till August, 1930, twelve different flocks of sheep have been imported from the Union, totalling about 2,500.

Scab has been a serious drawback in the district. During 1929, from February till May, while visiting the different flocks in the district, it was found that practically every flock was infected with this disease, with the exception of

those imported from the Union. It is a pleasure to report that the position has greatly improved during the last 12 months, and during this period only two flocks were found to be slightly infected.

How to Prepare a Farm for Sheep.—Fencing should receive first consideration. It is, however, difficult to lay down hard and fast rules as to how individual farms should be fenced. Before any internal paddocking is commenced the situation should be thoroughly studied and every farm treated on its own merits.

An attempt will be made in this article to describe an ideal way of fencing which would suit practically every farm.

For example, we will take a 1,500 morgen farm. First ring-fence the boundaries with five or six strands of barbed wire. Standards should be 15 yards apart, with three droppers in between. Straining posts should be from 250 to 500 yards apart, as the situation requires. If possible, the homestead should be more or less in the centre of the farm, and should be fenced in with about 100 morgen of land. This we will call the central paddock.

A hospital camp of about 10 morgen should be made inside the central paddock for all sick and weak sheep, in addition to which about 20 morgen of land should be fenced and planted to winter feed.

From the outside of this *central* paddock the fences of the other paddocks can be put up in a straight line or as the situation requires to join up with the boundary fence. The nearest point of the boundary fence should always be considered, as this would help in saving labour and material. Each of these paddocks should have access by a gate into the central paddock, and the outside paddocks should also have gates at convenient places leading into each other. This would serve when shifting stock from one camp to the other and for the flock-master to get about.

Veld rotation is the secret of good management. This can only be practised by sub-dividing the farm into paddocks, and so starving out those worms that cannot be controlled by dosing, e.g., nodular worms. Swampy veld should be fenced off or drained.

Vermin-proof Sleeping Paddocks.—These should be erected in each paddock to put the flock in during night. Fence in one acre of land by putting in permanent wooden poles 5 yards apart, with two droppers in between. The poles must be 7 ft. 6 ins. long. The holes must be dug 18 ins. deep, so that the poles will measure full 6 ft. above the ground. Put one strand of galvanised plain or barbed wire right at the bottom inside; one strand 2 ft. from the bottom inside; four strands of barbed wire 6 ins. apart starting 4 ft. from the bottom outside. Now fasten on the inside of the kraal (all round) 4 ft. of jackal-proof netting wire, care being taken to leave no weak places when doing this work. Take a piece of barbed wire 3 ft. 6 ins. long, fasten the ends to each other, put a cross of barbed wire over, and nail on to every pole. No leopard will attempt climbing over the poles, as this would stop him. Gates should receive special attention. The sites of sleeping paddocks should be chosen when the weather is at its worst, so as to make it possible to select a place where the best natural shelter will be available in all kinds of weather. Small stone kopjes are ideal for that purpose, otherwise black wattle shelter belts can be put in on two or more sides of the paddock, at least 12 yards away from the fence. After three or four years' time the black wattles will give the necessary shelter. If the farm has no natural sheltering places, farmers would be well advised to plough in every paddock and sow black wattle seed in the form of a cross. Black wattle grows wonderfully in the district, and it is unnecessary that stock should be left without shelter. If these sleeping paddocks are sufficiently large to afford grazing, they soon become hot-beds of worm infection.

The Importation of Sheep.—When buying sheep to farm in the Melsetter district, constitution and health should receive first consideration, and when the wool is considered, density should have preference to length, as this helps to keep the rain out. When importing sheep from the Union, they should be in first-class condition, and free from all kinds of worm parasites. The age should be from two to six teeth. It is not advisable to import sheep heavy in lamb. Sheep should be imported between May and September, May and June being the best months. Sheep imported from the Union

to suit local conditions should come from the high veld of the Transvaal, the Natal Province, Harrismith, Vrede (Orange Free State), Griqualand East, Barkly East, Dordrecht, Cape Province, and where conditions are somewhat similar to those of their new home.

When to Lamb.—To have lambs in the best time of the year rams must be put with the ewes from the beginning of November and removed in the latter part of December. Lambs will then be born during April and May. Lambs born later than the middle of June will suffer from worm parasites during the following rainy season. Spring lambs are always a failure.

When to Shear.—Shearing should be done during September and October so as to allow time for a new growth of wool before the heavy rainy season sets in. This is generally during December and the following months.

When to Inoculate for Blue Tongue.—If shearing is done during September, it will be best to inoculate *three to four weeks after the shearing is finished.* If, however, shearing is done in October, it will be advisable to inoculate *three to four weeks before shearing*, so as to allow time for the sheep to recover from the re-action caused by the blue-tongue vaccine. Before inoculating, full instructions should be obtained from the Veterinary Department.

Dosing for Worms.—Dose regularly once a month from the beginning of November till the end of May, and every two months from June to October. The success of sheep farming is largely dependent on regular dosing The Government wire worm remedy is recommended for this purpose, and the instructions given should be closely followed. An excellent pamphlet on the treatment of the internal parasites of sheep has been issued by the Department of Agriculture. (See *Rhodesia Agricultural Journal* or Bulletin No. 760.)

When to Burn the Grass.—The best time of the year to burn veld for early spring grazing is during August and September and for winter grazing January, February and March.

Veld burnt in August and September will supply good grazing for all stock up till March, or perhaps right through

the following winter if it is well stocked. Veld burnt in January, February and March will supply ideal grazing for both sheep and cattle right through the winter, that is, if no army worm appears on the scene.

When not to Burn.—It is not advisable to burn during November and December, and it is useless to burn during May, June and July, as very little grass will grow if burning is done in mid-winter.

Winter Feeding.—When a farmer has come to the stage when his farm is fully stocked and consequently no old veld is left which he can burn during January and February for winter grazing, he will have to start growing winter feed for his ewes and lambs. It is not yet necessary to grow winter feed for dry sheep.

What to Grow for Winter Feed.—Winter oats is perhaps the most suitable crop to grow without manure. Sow five or six bags of winter oats for every hundred ewes which are expected to lamb; if this done there will be no difficulty in rearing lambs. The oats should be sown in February, and the ewes put on it from mid-June for about two hours a day. It may not be necessary to feed all the ewes, as some ewes will easily rear their lambs without any winter feeding. Only the weak ones can be picked out in that case.

Carrying Capacity of the District.—Local opinion considers the carrying capacity to be from 1½ to 4 sheep per morgen, and in the writer's opinion 2 sheep per morgen and about 100 head of cattle extra to every 1,000 morgen would be a safe estimate. Winter feed should be grown for ewes and lambs.

Troubles from Vermin.—The greatest drawback to sheep farming in this district is *vermin, i.e.*, leopards and wild dogs, more especially the former. Heavy losses still occasionally occur through the depredations of these pests. Co-operation between neighbouring farmers is necessary to stamp them out.

How to Destroy Leopards.—Don't go out leopard hunting if there has been no kill. It is a waste of time in this district, with its impenetrable bushes and kloofs. Tempt the animal by leaving an old sheep or a few goats

outside the leopard-proof camp for him to kill. Keep on; don't get tired; the old sheep or goats will later on get so used to being left out that they will turn out by themselves to stay outside. The herd boy should get instructions to look first thing in the morning if the outsiders are still there. If not, the spoor should be followed where a carcase has been dragged along. When the carcase is found, the nearest neighbours should get notice of the occurrence and the nearest *leopard dog* sent for, even if it is 20 miles away. If it is early enough, the leopard dog can be put on the spoor the same day, but it is usually best to start early (before sunrise) the following morning, and in nine cases out of ten the leopard will be found within an hour after the dog has been put on the spoor. It is certainly not necessary to explain how to shoot a leopard when it has been traced by the dogs. Care should, however, be taken not to miss or wound. Leopards are dangerous animals *when wounded,* and should in that case only be followed up in company with armed men. The value of a leopard dog can safely be put at £50.

The definition of a leopard dog is any dog, no matter what breed, which, after being put on a leopard spoor, will follow the trail, discarding any other scents which may cross it, and which will start barking at the leopard as soon as it comes into sight.

If no leopard dog is available, traps or trap-guns can be used. As there will always be someone in the neighbourhood who can give a hand in this, no explanation will be given in this article.

To try to poison a leopard should be the very last resort, as generally the dogs are poisoned and the leopard escapes unhurt.

How to Train Dogs for Leopards.—There can be a leopard dog or dogs on every farm if only the farmer will go to the trouble of training. It is wonderful how soon dogs will realise that by helping to kill a leopard they have done a brave deed somewhat out of the ordinary. Bend down, pat them, give them to understand that you greatly appreciate their courage. Next time when you put them on a leopard spoor they will sacrifice their lives just for a little patting and praising from their master. Later on they will

become *leopard killers* by nature, and will always be on the outlook for an opportunity. When training dogs for leopards do not praise or pat them when a wounded buck or anything of that sort is caught by them, as this will lead to a misunderstanding. To try to train a dog for this purpose which is a coward by nature is useless.

Wild Dogs.—All farm boys should get instructions when finding a troop of wild dogs in the act of killing any animal to drive them away (not shoot) and send word to the house. Cut about 40 or 50 pieces of meat, poison this, and strew all round the carcase. The neighbours should be informed and a hunt organised for the following day, as those that have escaped the poison will stay in the vicinity waiting for their companions to turn up. Whole troops of wild dogs can be killed in this way.

Jackal and Birds of Prey.—If a jackal or a bird of prey kills anything, the best thing is to put poison down which means certain death to them. Great care should be taken not to poison the dogs, which should be looked upon as the most valuable animals on the farm.

Skin Dip.—At present there are only a very few sheep dipping tanks in the district, therefore a skin dip will come in very handy in cases of urgency. This skin dip can be made on the same principle as a tub such as is used for tanning. Drive in four poles 3 ft. above the ground, 2½ ft. apart on the one side and 5 ft. apart on the other side, so as to give it an oblong shape. Fasten four cross beams on top of these poles. Take the biggest beast skin available, soak well before using, and fasten the sides on to the cross beams. Put in 30 or 40 gallons of water and allow it to stand in that position for a few days. If it is a fairly big skin, two sheep can be dipped at the same time and as many as 300 sheep in one day.

Bad Years.—Bad years in Melsetter may be described as those when the rainfall is above normal. Local opinion is that out of every five years two can be put down as bad years. If care is taken, however, that flocks are in good condition and free from diseases by December, no abnormal losses should be suffered during the rainy season.

Conclusions.—In the Melsetter district sheep farming is only to be recommended to those who look upon it as a means of a living. There is a ready market for slaughter sheep, and in the past wool from the district has been sold at remunerative prices.

Sheep farming is in a way like the roads of the district—full of unexpected bumps, hairpin bends and steep gradients.

Those who accept the unexpected bumps as part of the business, who carefully evade the precipices, and who change into low gear when necessary, will come out on top both on the road and at sheep farming.

Agricultural Botany.

The need for a botanical service in the Department of Agriculture has been realised for many years, and a considerable measure of attention has already been given to this subject. Owing, however, to a limited staff, the officer responsible for botanical work has always been called upon to devote the major part of his time to other duties, such as general field husbandry, plant pathology, etc. A special botanical branch—forming part of the new division of plant industry—has now been provided under the general direction of Miss Sydney Stent, Senior Botanist, assisted by J. M. Rattray. Miss Stent for many years held the post of Agrostologist in the Union Department of Agriculture, and has only recently retired from that position.

In the Union Miss Stent was principally engaged on work connected with the grass flora of South Africa, with a view to the improvement of pastures, and here in Rhodesia she will be closely associated with the Chief Chemist in his pasture-land investigations on the Matopo and Marandellas farms. The wide experience which Miss Stent has gained in the Union will stand her in good stead in rendering

useful service in Rhodesia, both to other sections of the Department and to the farming community.

The branch will be prepared to assist farmers in all botanical problems which may arise, such as grass identifications, with reports on the pasture or hay value of the particular variety submitted and the determination of suspected poisonous plants, noxious weeds and other plants of believed economic importance.

Associated with its investigation of native and other herbage plants it is anticipated that the botanical branch will assume direction and supervision of the various grass and pasture plots already established or to be established on the Agricultural Experiment Station, Salisbury, the Marandellas Experiment Station, the Tobacco Experiment Station and possibly also at other centres, as well as arranging co-operative grass variety experiments with selected farmers.

For the efficient performance of botanical duties, a well-stocked and equipped herbarium is necessary, and the botanists will need considerably to augment the existing collections in the herbarium. Specimens submitted will assist in this direction, but farmers are also invited to interest themselves in the work and at the same time increase their knowledge of the plants and grasses of their own farms by making and forwarding collections of specimens for identification. Reports will then be forwarded to the senders, giving the name of the plant or grass, its economic value, if known, and any other useful information on the subject which may be available. Farmers, when submitting specimens, are asked to give all the particulars they can in respect to each, such as local name, date collected, habit of growth, class of soil on which found, whether eaten by stock or useful for any other purpose, time of year of flowering, altitude of farm and so forth.

The following rules should be observed when sending in plants for determination:—

1. The specimen should be as complete as possible—that is, including leaves, flowers, and, if possible, seeds or fruits, and in the case of grasses or bulbous- or tuberous-rooted plants, the roots or bulbs as well.

2. Specimens should first be dried between sheets of newspaper or blotting paper and when packed should be kept flat and rigid between two boards or cardboards. The whole should be tightly tied up in paper and addressed to the Botanist, Department of Agriculture, Salisbury, marked "O.H.M.S. Botanical specimens for identification."

3. A label should be inserted with each specimen, giving an identification number and available information regarding the plant, duplicate specimens, similarly numbered, being retained by the sender.

4. Specimens such as tall grasses, which are too large to go easily on one sheet, should be bent over once or twice to bring them within the required compass.

The Department of Agriculture confidently looks to farmers to assist in the building up of a complete herbarium collection of Rhodesian plants and grasses, and any farmer or collector who is willing regularly to make and forward collections will be supplied with collecting labels and cardboard sheets for packing purposes.

PIGS FOR SALE.

Pedigree Large Black and Large White boars and gilts —the progeny of pigs recently imported from England—will be available for sale from the Gwebi farm from February onwards. Orders may now be booked. Prices: five guineas for animals of five months of age, and one additional guinea for each additional month of age up to a maximum of seven guineas at seven months old or more. No pedigree pigs will be sold at a younger age than five months. Prices are f.o.r. Gwebi, and crates are returnable at cost of purchaser.

Enquiries in the first instance to be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury.

Making a Garden in Rhodesia.

HINTS FOR BEGINNERS AND NEWCOMERS.

(Concluded.)

By Mrs. E. M. V. Carnegie.

GENERAL.

Manure Water.—To make manure water, put a bucket of cow manure into a barrel or drum and add half a bucket of lime, then fill up with water and stir well.

When settled, use it in the proportion of a pint to every quart of fresh water.

Water may be added and the stirring repeated till it is practically colourless, when fresh manure and lime must be again put in.

Top Dressing.—Top dressing consists of applying a layer of well rotted manure around the surface of rose beds, shrubs, etc. Equally good is thoroughly rotted leaves or grass, and this should be done just before the new shoots begin to grow.

Wash for Roses.—A good wash for ridding rose trees of insects is made of half a pound of soft soap and an egg cup full of paraffin mixed with a quart of hot water. This must be stirred into an emulsion and then added to a gallon of warm water, which is syringed over the plants at night and washed off with clear water in the morning.

Wash for other Plants.—Steep coarse tobacco in hot water, half a pound to a paraffin tin three parts full, for half an hour and let it cool. Then syringe in the evening any plant affected with green fly, scale or thrip, washing off with fresh water in the morning.

To Make Pink Hydrangeas Blue.—First add one tablespoon of alum to a gallon of rain water and apply to plants twelve hours after mixing. Follow this next day with a tablespoon of saltpetre and half a tablespoon of oxide of iron in three gallons of water, which should be used twenty-four hours after mixing.

Apply both weekly and see that the plants are moist beforehand.

Begin using when the plants are starting their new growth and continue until blooming time.

To Make Crazy Paving.—Crazy paving is easy to make. If you cannot get a sufficient number of flat-sided stones, you can always get a bag of cement and a quantity of small stones and sand.

These must be mixed in the proportion of one of cement, two of sand and four of small stones or broken brick, which does equally well.

The cement and sand should be mixed first, and then the stones or broken brick added, all being carefully measured.

If broken brick is used it should be wetted before being added to the other ingredients, and when all are thoroughly mixed, water is stirred in little by little till the whole forms a stiff paste.

This is a concrete and must be used as soon as made and before it begins to harden, so be careful to mix only enough for the amount of slabs you are going to make.

Before mixing your concrete you must, of course, have the moulds ready.

These are made of wood (1 in. by 2 in.) in various irregular shapes, and should not be too big. A foot square is quite big enough for the largest. The more moulds you can make the better, as it will expedite the work to have a good number.

When you have mixed sufficient concrete to fill all the available moulds, make up also a mixture of one part of cement to two of sand.

Now dip your mould in water, stand it on some flat surface and fill it with concrete. Press it down firmly and see that there are no stones above the top of the mould. Add a thin layer of sand and cement mixture and level it off with a smooth stick.

Cover with a wet newspaper or sack and proceed to the next.

Don't try to do more than one at a time.

Next day you can take the slabs out of the moulds, place them on a flat surface and cover them with damp earth.

They should be left like that for at least a fortnight, damping the earth as often as necessary.

Festina lente is a good motto for the gardener.

When making the path the slabs are simply set in the earth. It is best to dig out the soil to a depth of about two inches, then flatten the surface and place the slab in position, stamping it down firmly and filling up the spaces with earth.

Grass may be planted between the slabs, or any other tiny plant, though if nothing is done in this way seedlings will soon find a resting place for themselves there.

DO'S AND DON'TS.

Do	**Don't**
Keep the soil worked.	Cultivate the soil when wet.
Disbud if you want fine flowers.	Let your seed boxes get dry.
	Plant at the wrong season.
Give manure water regularly.	Prune at the wrong time.
Make use of your garden rubbish.	Cut everything indiscriminately when pruning.
Plan your garden and make the most of the space you have.	Allow weeds in your garden.
	Plant any shrub or tree too deep, nor allow earth to be heaped against the stem or trunk, as this causes ill health in the plants and also encourages attack by white ants.

Plants that Flower in January, February and March.

Asters	Dahlias	Nicotiana
Antirrhinum	Dianthus	Nemesia
Amaranthus	Delphinium	Nigella
Aquilegia	Eschscholtzia	Nasturtium
Ageratum	Gaillardia	Pansies
Arctotis	Godetia	Petunia
Balsams	Gypsophila	Pentstemon
Barberton Daisy	Geraniums	Pyrethrum
Calendula	Golden Feather	Phlox
Candytuft	Geum	Poppy
Cosmos	Hunnemannia	Sunflower
Coreopsis	Heliotrope	Scabious
Carnations	Hollyhock	Sweet Peas
Convolvulus	Lupins	Salvia
Cornflower	Linum	Statice
Single Chrysanthemum	Larkspur	Verbena
Cannas	Marigold	Zinnias
Daisies of all kinds	Mignonette	

Plants that Flower in April, May and June.

Asters	Eschscholtzia	Pansies
Antirrhinum	Gaillardia	Petunia
Arctotis	Golden Feather	Phlox
Balsams	Godetia	Poppy
Ageratum	Gladiolus	Portulacca
Anemone	Hunnemannia	Ranunculus
Aquilegia	Hollyhock	Salpiglossis
Alyssum	Larkspur	Stocks
Candytuft	Linum	Sunflower
Cannas	Lupins	Sweet William
Coreopsis	Linaria	Sweet Peas
Carnation	Marigold	Sweet Sultan
Chrysanthemum	Mignonette	Scabious
Clarkia	Mina Lobata	Statice
Calendula	Matricaria	Salvia
Dianthus	Nicotiana	Verbena
Delphinium	Nigella	Violets
Daisies	Nasturtium	Zinnia

Plants that Flower in July, August and September.

Asters	Foxglove	Nicotiana
Alyssum	Freesia	Pansy
Antirrhinum	Gaillardia	Petunia
Aquilegia	Godetia	Phlox
Calendula	Golden Feather	Poppy
Calliopsis	Gypsophila	Ranunculus
Carnation	Larkspur	Salpiglossis
Candytuft	Lupins	Stocks
Cornflower	Marigold	Sweet Peas
Delphinium	Mignonette	Verbena
Dianthus	Marguerite	Virginian Stocks
Eschscholtzia	Nasturtiums	

Plants that Flower in October, November and December.

Antirrhinum	Dahlia	Nemesia
Amaranthus	Eschscholtzia	Nigella
Ageratum	Gaillardia	Pansy
Anchusa	Golden Feather	Petunia
Aster	Geum	Phlox
Arctotis	Gladiolus	Pentstemon
Alyssum	Godetia	Pyrethrum
Aquilegia	Hollyhock	Portulacca
Balsam	Heliotrope	Poppy
Candytuft	Hunnemannia	Ricinus
Canna	Larkspur	Salpiglossis
Carnation	Lupin	Salvia
Coreopsis	Linaria	Sweet Peas
Clarkia	Lychnis	Sweet Sultan
Cosmos	Linum	Scabious
Chrysanthemum	Marigold	Statice
Cornflower	Matricaria	Sunflower
Cockscomb	Mignonette	Sweet William
Convolvulus	Mina Lobata	Verbena
Dianthus	Nasturtiums	Violets
Delphinium	Nicotiana	Zinnias

Sericulture in Southern Rhodesia.

MR. BRETON'S REPORT.

(Concluded.)

Materials.—The tobacco grower already has in his grading shed a building that can be easily adapted for silk worms to start with, but if the scheme of a silk worm village matures he could not afford to erect similar expensive structures for an extension, nor could missions, orphanages and schools afford to put up an elaborate rearing house. Due regard must also be had to the eventual need of the native. So the cheapest possible structure consistent with resistance to the weather should be aimed at. My idea would be a rectangular building of mud and wattle or raw brick or pisé thatched with grass. If a bamboo or rush lining could be put under the thatch, so much the better. The size should be 18 ft. x 12 ft., with walls 8 ft. high. It should be fitted with double doors, one of wood and the other of wire gauze, and wire gauze windows without glass on all four sides, having wooden shutters on the outside. The floor could be of earth. The idea is to have a building which can be well ventilated and yet not draughty, shaded from the sun and capable of being closed at night to conserve as even a temperature as possible. Before each hatching of the eggs the rearing house should be treated with lime-wash or watered down cow dung.

As regards internal fittings, silk worms are fed on beds or shelves. These may be constructed of bamboo or rush grass, are carried by wooden uprights and are placed in tiers 18 ins. apart. Four tiers from 1½ ft. to 6 ft. above the floor would be found the most convenient arrangement. On the basis of 18 ft. x 12 ft. internal measurements, the hut could contain two rows of tiers, each 15 ft. long, to allow of 1½ ft. space at either end, and 3½ ft. wide to allow 1½ ft. between

the beds and the walls, and a corridor of 2 ft. down the middle of the room between the two rows of beds. The construction of both building and fittings is simple, and if tree poles are used for uprights and cross-pieces, the whole of the material for construction should be ready to hand, except the wooden door and the wire gauze. The window shutters could be constructed of old petrol boxes.

Supervision.—The supervision of sericulture in countries where it is an established industry is entrusted to a special section of the Agricultural Department, consisting of an officer in charge and a number of inspectors under him, regulated by the area of territory to be covered; and it is a whole-time job for the officer if his duties are to be carried out efficiently. These duties may be briefly summarised as follows:—

To advise from what part of the world eggs should be imported.

To receive and care for the eggs on arrival.

To conduct the hibernation of the eggs.

To inspect the cultivation and pruning of the mulberry.

To inspect the construction of the huts destined for rearing of the worms.

To supervise the distribution of the eggs.

To supervise the incubation and hatching of the eggs.

To determine the quantity of eggs to be raised by each individual consistent with the amount of mulberry grown by him.

To carry out periodical inspections of the rearings, with advice and correction where necessary.

To supervise the collection of the cocoons.

To supervise the treatment of the cocoons to render them merchantable.

To carry out experiments in reproduction.

To determine the most suitable race or races of silk worms for the territory.

To carry out research in cross-breeding with a view to selfing a race for reproduction locally.

To supervise and control local reproduction by commercial egg producers if and when such are licensed by the Government.

To supervise the affixing of banderoles on boxes of eggs produced locally.

To train up young men in sericulture for posts as inspectors.

It will be seen that the officer in charge will be a busy man, but as the industry progresses his duties will become easier and more stereotyped, and some of them would be shouldered by the producer and others by the buyer of the cocoons.

Marketing of Cocoons.—It is one thing to produce an article hitherto unknown commercially in the territory, but it is quite another to find a ready sale for it. The usual marketing channels do not know how to deal with it, are unable to judge the different grades of quality and are nervous of the financial results when they come to dispose of it. They are unlikely to pay anything like the full market value, and the producers become discouraged at the very outset.

The usual method with cocoons is for the producers to sell them while they are in the "green" state and perishable, i.e., while the chrysalides are alive inside them and are liable to turn into moths which would cut their way out of the cocoons and render them practically valueless. The buyer must have the means and necessary knowledge to deal with the cocoons to render them merchantable. As the cocoons are brought in they are placed in a steam chamber or a hot air dryer and the chrysalides are killed by suffocation, the liquid matter in them is dried out and the cocoons can then be packed in sacks and exported. It will be seen that a certain amount of technical knowledge and skill is required of the prospective buyer.

There appear to me to be three alternatives open to the Government for creating a market:—

(a) To buy the producers' cocoons itself.

(b) To grant a concession with a guarantee to a firm conversant with the business.

(c) To leave the marketing to take care of itself and trust to the law of supply and demand to solve the question.

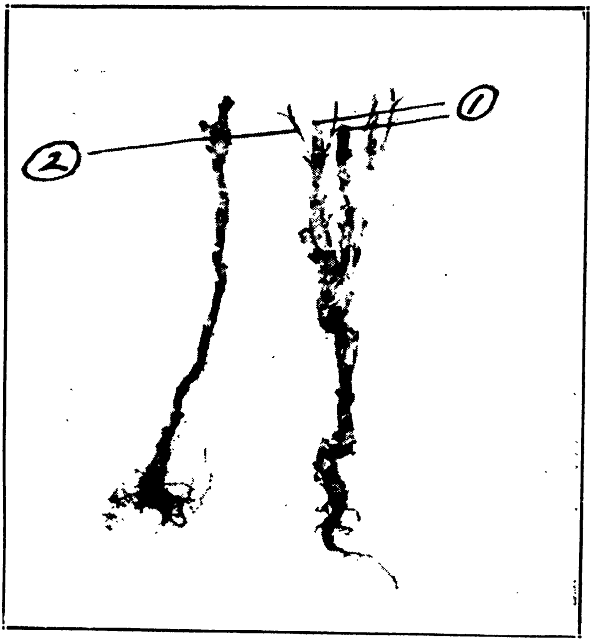
[*Mr. Breton deals with each alternative in detail, but we have been obliged, for reasons of space, to omit what is written.*—Ed.]

SUMMARY.

This completes my report, and it may be convenient if I summarise the conclusions I have come to.

1. The mulberry of the right variety for feeding silk worms will grow profusely, as far as I can see, all over the territory.
2. Climatic conditions appear to be satisfactory in as many places as are necessary for sericulture to become an important industry.
3. To accustom natives to the industry and to get them to build rearing houses will be a slow and arduous process.
4. The industry should be carried on by both Europeans and natives.
5. The hibernation of the eggs in the territory itself is a *sine qua non.*
6. The supply of eggs and mulberry cuttings should, in the early stages, be gratuitous, and grants-in-aid to natives for building rearing houses when the time comes should be considered.

I may add that the tropics have a way of upsetting calculations when it comes to applying sub-tropical theories to them. My own ignorance of tropical conditions may have led me to under-rate difficulties which I have foreseen and to make no allowances for those which have escaped me or which may crop up hereafter. That will be an inherent defect of this report.



A witch weed plant, showing (1) points where original stems were cut just below ground level, (2) new shoots arising below these points.

Single branch of witch weed plant, showing (1) flowers, (2) seed capsules.

Witch Weed.

By S. D. Timson, M.C., Inter. B.Sc. (Agric.) Lond., Dip. Agric. (Wye), Assistant Agriculturist.

The very serious damage caused to the maize crop by this parasite is sufficient excuse, if any be needed, for once again issuing a warning to farmers concerning the urgent need there is to take immediate steps to control its spread.

Bulletins Nos. 708 and 759, issued by this Department, incorporate most of our knowledge of this pest and the recommended methods for its control.

If drastic steps are taken in time, before the infestation has become severe, it is a comparatively simple matter to deal with the parasite by hand cultivation and machine cultivation, carried out every ten to fifteen days from its first appearance in the lands, usually during January. But if the pest is allowed to spread unchecked for a season or two, it rapidly assumes very serious proportions and may become the limiting factor in maize production.

There is little to add to the information already published (Bulletin 759) concerning methods of control, but one or two points need correction or emphasis. It is almost useless and a waste of money to hand cultivate lands infested with witch weed once or twice only during a growing season, or even three times in a season, however well the work is done. Hand cultivation combined with machine cultivation must be carried out thoroughly every ten to fifteen days after the first appearance of the weed above ground. If a longer interval is allowed between cultivations, a proportion of plants will be permitted to flower and set seed. In this connection a considerable body of evidence was collected this year, which goes to show that after a witch weed plant has been cut near the surface during cultivation, it may make new growth from the same stem so rapidly as to

produce flowers within ten days, that is, in about half the time the plant normally takes to produce its first flowers when undisturbed by cultivation. Cultivation to destroy witch weed should be done as deeply as possible, as this will delay—and to some extent perhaps in the harder soils prevent—new growth from the cut stems appearing above ground and flowering. The damage done to the roots of the maize must be neglected, as the proper control of the parasite is of greater importance.

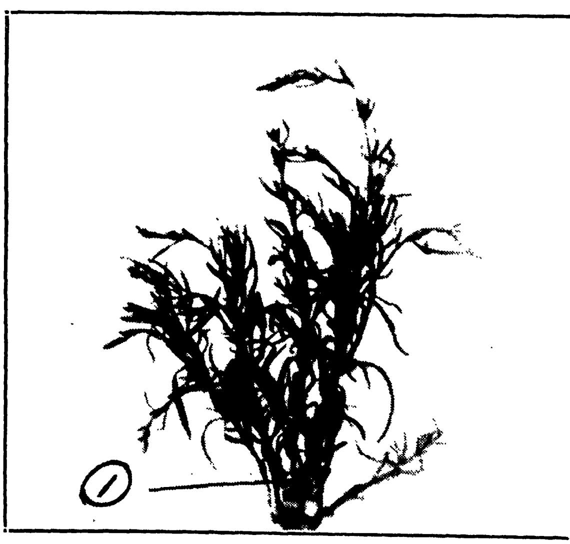
More evidence is needed before a definite minimum period between cultivations can be laid down, but it is almost certain that not more than fifteen days can be safely allowed.

The broadcast planting of maize thickly as a trap crop has been recommended in the past, but the writer can no longer recommend this method of planting the maize, as it becomes rapidly smothered with weeds, makes very poor growth and in consequence does not properly do its work of germinating the witch weed seed. It is now recommended that maize *as a trap crop* should be planted by machine in rows as close as will permit of adequate cultivation (say 26 inches apart) and that the seed should be dropped at intervals of about 9 to 12 inches in the rows. The crop should receive two cultivations to clear it of weeds and assist it to grow rapidly and do its appointed work.

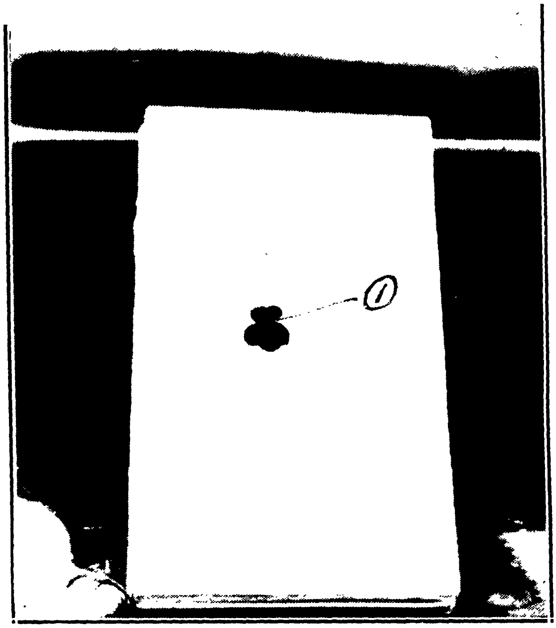
An experiment carried out on the farm of Mr. McCall, of Glendale, and completed during the past season, provides evidence of the efficacy of trap cropping witch weed. A trap crop of maize was planted dry before the rains in 1928, ploughed under six weeks after germination, and the land at once planted to ground nuts. The ground nuts yielded a return of 12 bags per acre. In November, 1929, a commercial crop of maize was planted on the same land, and very few witch weed plants made their appearance. In 1927-28, prior to the commencement of the experiment, this land was found to be somewhat severely infested with witch weed, and Mr. McCall is satisfied that the trap crop of maize has very considerably reduced the amount of the parasite present in the land.

It must not be concluded, however, that one trap crop will suffice to control witch weed. Some farms in the country

A well developed witch weed plant growing on roots of Sudan grass. Such a plant may produce a million seeds.



Numerous new branches thrown out by witch weed plant after stem has been cut below ground level during cultivation. (1) Point where original stem was cut.



Silhouette of single flower of witch weed to show its shape, front view. (1) Minute lemon yellow "throat." Petals brilliant scarlet in colour.

A maize plant infested with witch weed which has not yet appeared above ground, showing the typical rolling of the leaves towards the midrib and the general drooping appearance of the whole plant. The leaves are light bluish-green in colour.

are so severely infested now that at least two and probably three successive trap crops will be needed to reduce the amount of the parasite to the point where it can be easily controlled by cultivation.

After the past two years' experience it is considered desirable to emphasise the necessity of taking the very first available opportunity of ploughing under the trap crop after it has been growing for six weeks. If necessary, all other work on the farm should be put aside to ensure that this work is done properly and without delay. If the ploughing under of the trap crop is delayed, it may mean that wet conditions may render it impossible to carry out the work until the parasite has flowered and set seed. Although the trap crop could possibly be left in safety on the land for a further two or three weeks to continue its work, it is considered that such a course is too dangerous a gamble with the weather.

In combating witch weed, one of the most valuable aids the farmer has ready to hand is the check-row system of planting maize. When done by hand this method of planting requires a large supply of labour, and it is a slow method. But there are on the market check-row planters costing only £5 each more than the ordinary type of maize planter. They are simple to work, reliable, and will plant almost as big an acreage in the day as the ordinary planter. The writer knows of a number of check-row planters which are giving complete satisfaction in this country.

Check-row planted maize allows for machine cultivation both ways, and thus greatly reduces the amount of hand cultivation necessary to kill witch weed. If single oxen are used to draw the cultivators, then machine cultivation can be carried on until the end of the growing season. An illustrated article on how to make a cheap single ox yoke was published in the March, 1930, issue of the *Rhodesia Agricultural Journal.* Old mule harness can sometimes be bought cheaply and used for the same purpose. The writer strongly recommends the use of the check-row planter, combined with the use of single ox-drawn cultivators.

That this serious menace to the maize crop is spreading and increasing in severity there can be no doubt; and there

is also no doubt that it will continue to do so unless special and immediate steps are taken to control it. It is present in every district of the maize belt, and, in the opinion of the writer, very few farms, even among the newer ones, are free from it.

Those farmers who already know of its presence on their farms should take immediate steps to combat it, and those farmers who are not aware of its presence on their land should take steps to make quite certain that their fields are free from it. If they are unable to recognise the parasite, then they should take steps this season to make themselves familiar with its appearance, not only when it is in flower, but before it comes into flower.

A brief description of the plant, together with the accompanying photographs, may assist in identifying the plant, but if there is any doubt, then specimens may be sent to the Botanist, Department of Agriculture, for identification.

The witch weed is a small, erect plant with light green coloured, narrow, lanceolate leaves. The stem may be considerably branched, but under unfavourable conditions it may have a single unbranched stem. Both stem and leaves are characteristically rough to the touch, the latter being also rather thick and fleshy. The flowers are borne in the axils of the leaves and are a brilliant scarlet, with a minute lemon-yellow "throat," the under surface being also an even dull lemon-yellow in colour. The flowers are roughly half an inch in length by half an inch broad at the widest part. The first flowers are formed at the bottom of the stem.

There is little or no hope of a simple and rapid cure for the pest being found, and the methods of control outlined by this Department in the bulletins already mentioned must be resorted to. Officers of this Department are at the service of farmers to advise them with regard to the methods of control of the pest, suited to their particular local conditions, and will be glad to assist in every possible way.

Notes from the Irrigation Branch.

Irrigation Development.—During the recent circuit of the Water Court in Matabeleland and Southern Mashonaland fresh evidence was available of the present activity in irrigation development.

Applications for 18 irrigation schemes, totalling in all about 600 acres, were dealt with, and in all cases the schemes were either actually completed or the definite intention of proceeding with them next year was declared.

On Nuanetsi Ranch the suitability of the soil in the low veld for the growth of lucerne was strikingly demonstrated on an 8-acre patch near the homestead, where an excellent stand of Provence lucerne had been established. The manager stated that he obtained as many as ten cuttings per year, and that the best cuttings were obtained in the winter, which is contrary to the general experience at higher altitudes, owing to the relatively high average temperatures prevailing during that period in the low veld.

An area of about 50 acres is now being put down under lucerne on the Lundi section, and the land has been properly laid out in well graded terraced beds, which will permit of them being flooded with a good stream of water under control, and ensure the deep waterings which are so essential for a good stand of lucerne. It was interesting to note that about 60 earthern storage dams have been constructed on the ranch for the purpose of watering stock in areas which were formerly unavailable for winter grazing owing to the lack of permanent water supplies.

The supplies in these dams have lasted longer than expected, as the losses from evaporation and seepage have been less than anticipated, and it is intended to proceed with the construction of many more of these dams.

On one farm visited near Filabusi two earthern storage dams had been constructed for the conservation of flood water, which would be mainly utilised for the irrigation of summer crops during partial drought periods. The owner is satisfied that owing to the erratic and low rainfall ex-

perienced in this area it is necessary to provide such a form of insurance against loss from drought.

Some very fine crops of wheat grown under irrigation were observed in Eastern Victoria and Chilimanzi districts.

On Mr. Readman's farm, Campsie Glen, the existing water right has been fully utilised, and application was made for a further right in order that the acreage under wheat could be doubled next season.

It is also intended to considerably extend the area under irrigation on Mr. Brocklehurst's farm, Histonhurst, in the same locality. It was cheering to note the spirit of optimism amongst the irrigation farmers, which seemed to be quite unaffected by the prevailing severe depression.

Irrigation Experiments.—It is hoped that it may be possible next year to commence a series of irrigation experiments at the Matopos School of Agriculture with a view to determining proper cultural methods, depths and time of application of water and lay-out of irrigable lands under our local conditions, and thus improving crop yields. The investigations will be concerned mainly with the cultivation of wheat, lucerne and mixed pasture grasses, as it is considered that these are the three main staple crops to which attention should be directed. If these experiments are initiated, it will be possible also for short courses to be arranged for practical instruction in proper irrigation methods.

A training centre of this nature has been a long outstanding need, as irrigation farming is a highly specialised branch of agriculture, and the success or failure of an irrigation scheme is almost entirely dependent on the man who is using the water, as lack of knowledge of correct irrigation practice results in wasteful use of water, erosion and deterioration of the soil and consequent low crop yields.

The following extract from the report of the Irrigation Research Committee of the Economic Advisory Council is of interest, as it shows the nature of the crops grown under irrigation in other countries in the British Empire:—

"In Canada cereals are grown under irrigation, and also fodder crops, fruit and market garden produce. In British Guiana an important rice crop is so grown. This is also the case in West Africa. In South Africa there is

irrigation for citrus and other fruits, and also for lucerne. In Mauritius it is entirely for sugar cane.

"Cotton is grown under irrigation in the Anglo-Egyptian Sudan, where it is the principal product, and also in Palestine, Iraq and India. The three last mentioned countries also irrigate for sugar cane, but in Iraq and India the main irrigation crop is cereals. In the eastern Colonies —Ceylon, Hong Kong and Malaya—it is rice. Rice is also grown in Australian irrigation areas, but fruit has hitherto been their principal output. Now lucerne growing under irrigation as a protection from drought, which has been discussed for some years, is to some extent being practised. In New Zealand irrigation is wholly for lucerne and pasture grasses. The irrigated lands in New Zealand are situated primarily in Central Otago, where they have a total area of 78 square miles."

Soil Erosion.—Although it is ten years ago since the Union Drought Investigation Commission's report was published in which the far-reaching effects of soil erosion were emphasised, it is only recently that any combined action has been taken in the Union to fight the menace. A conference was held at Pretoria in November, 1929, at which it was decided that the Minister of Agriculture should be responsible for the policy governing soil erosion, and a strong advisory council was elected to assist him.

This council met for the first time on 14th July, 1930, when various important matters were discussed. One outcome was the unanimous decision of the council that an officer be appointed for the purpose of carrying out the council's instructions. This is the first appointment of an official whose sole duties are concerned with soil erosion, and marks definitely the Union's determination to overcome the evil.

The interesting account of Mr. Haviland's observations whilst on a tour of advice in Nyasaland, which was published in the last issue of the Journal, shows that planters in that Colony are also fully alive to the necessity for soil erosion protection measures, and that methods in use here have been adopted with success.

In our own Colony there is an ever-increasing demand for advice on soil erosion protection works in spite of the fact that many farmers who had previously received advice now set out the work themselves.

During the present year 148 visits on soil erosion advice have been paid to farms as compared with 124 last year, and in all 104 miles of contour ridges have been set out which will be capable of protecting approximately 3,100 acres of land.

Tractor Trials.—A report on the tractor trials near Brakpan, Transvaal, carried out under the supervision of officials of the Union Department of Agriculture, has recently been received. It is of interest to note the growing importance of the tractor in farming as practised in the Union, the number of tractors imported having risen from the modest figure of 167 in 1924 to a total of 2,696 in 1929.

Many valuable data are contained in this publication, which should be in the hands of all farmers who are interested in tractors. The field trials occupied a period of four days, and were confined to ploughing tests with mouldboard ploughs.

In all, 11 tractors took part in the trials, but it is to be regretted that a number of well-known makes were not represented, and it is rightly pointed out that any claims of performance by such machines at privately conducted trials cannot be justly compared with these official results. The rated horse-power of the tractors on the draw bar varied from the 10/15 h.p. Fordson to a 30 h.p. Clitrac. Two Avance, two Lanz and one Mercedes-Benz operated on crude oil, whilst the remainder of the tractors operated on power paraffin.

Each tractor ploughed up four uniform blocks of land, the areas being as follows: Blocks I. and II., 2 morgen; Block III., 1.6 morgen; and Block IV., 1.5 morgen; the depth of ploughing specified being 10 inches in Blocks I. and III. and 8 inches in Blocks II. and IV.

There were some extraordinary divergences in the time taken to plough these areas by the different tractors, due mainly to the horse power of the tractor affecting the number of furrows that could be ploughed in one operation. For the deep ploughing test on Blocks I. and III. the best performance was set up by a Case "L" tractor (26 h.p. on draw bar) using power paraffin, which ploughed the total area of 7.39 acres to an average depth of 9.8 inches,

using a Ransomes Consul three - furrow plough, in 7 hours, as compared with the average ploughing time of all tractors of 11 hours 53 minutes and the worst performance of 15 hours 43 minutes. In the shallower ploughing test on Blocks II. and IV. the best performance was that of an Avance tractor (20 h.p. on draw bar) using crude oil (Tarakan), which ploughed the total area of 7.62 acres to an average depth of 8.1 inches, using a John Deere four-furrow plough, in 5 hours 54 minutes, as compared with the average ploughing time of 8 hours 59 minutes and the worst performance of 12 hours 12 minutes. The fuel consumption per acre also showed very wide variations, as the following tabulations show:—

	gls. per acre.
8-*inch Ploughing Test*:—	
Crude oil tractors (4)—	
Average consumption	1.97
Lowest consumption—Avance tractor (Solar oil)	1.66
Highest consumption	2.34
Power paraffin tractors (6)—	
Average consumption	2.83
Lowest consumption—Case "L" tractor (Voco power paraffin)	2.23
Highest consumption	3.55
10-*inch Ploughing Test*:—	
Crude oil tractors (4).—	
Average consumption	2.69
Lowest consumption—Avance tractor (Solar oil)	2.14
Highest consumption	3.22
Power paraffin tractors (6)—	
Average consumption	3.19
Lowest consumption—Case "L" tractor (Voco power paraffin) ...	2.26
Highest consumption	3.91

Based on Johannesburg prices for crude oil and power paraffin, the average fuel cost per acre using crude oil was 2s. 0½d. as compared with 4s. 3½d. using power paraffin. These figures compare very closely with those previously published of trials carried out at Gwebi.

C. L. R.

Operations of the Maize Loan Committee.

The Maize Loan Committee has now completed its duties and it is possible to give certain information regarding the manner in which the fund has been dispensed. Loans amounting to a sum of £43,185 have been definitely approved and a further £9,471 has been provisionally approved, subject to certain conditions being complied with by applicants. Assuming that the latter applications are authorised, a total sum of £52,656 will have been advanced and distributed amongst 263 farmers, the average loan granted being approximately £200.

The maximum sum approved for any applicant has been £500, and 12 farmers have benefited to this extent; 15 maize growers have received loans of between £400 and £500, 22 growers of sums between £300 and £400, 46 growers of sums between £200 and £300, 77 growers between £100 and £200, and 91 farmers have been advanced sums of less than £100.

In all, 351 applications were dealt with by the committee, and of these 263 were approved. Of the remainder, 65 were refused and 23 were withdrawn after discussion with the committee.

Loans have been dispensed by districts as follows:—

Mazoe	£33,709	amongst	128	growers.
Lomagundi	8,262	,,	57	,,
Hartley	2,450	,,	25	,,
Salisbury	7,513	,,	42	,,
Midlands	412	,,	7	,,
Various	310	,,	4	,,
Total	£52,656	,,	263	,,

The committee held 22 sittings and interviewed applicants at the following centres:—Salisbury, Amandas, Bin-

dura, Shamva, Glendale, Banket, Sinoia, Hartley, Gatooma and Gwelo.

Repayment over three years of the sum advanced has not in all cases been permitted. If, owing to an applicant's financial position, the committee has had serious doubts of his being able to carry on his farming operations for more than one year, the total number of bags of maize repayable has, with the consent of creditors, been made a first charge against next season's crop. A similar policy has been adopted in the case of lease holders whose tenure of the land for three more seasons has been uncertain.

Throughout its sittings the committee has employed every available means of safeguarding public funds and ensuring, as far as is possible at this juncture, repayment in kind of the sums advanced.

In all cases where such outstandings have existed the first charge against any loan approved has been for payment of arrear native wages. Where circumstances have permitted, the next charge has been payment for fertiliser or farm seeds purchased or required to be purchased for the present season's crop, and in this connection special regard has been given to the applicant being enabled to obtain seed of suitable green manure crops in sufficient quantity. Recipients of the loan are being required to submit their certified accounts for seeds and fertilisers purchased to the committee in order that payment may be made direct to the vendors by the Land Bank. Due regard has been had to discounts on fertiliser accounts to enable the purchasers to benefit to the fullest in this respect, and the committee gratefully acknowledges the co-operation of the various vendors of artificial fertilisers in this matter. In those cases where it has not been possible—owing to the need to allocate sums for current native wages over the next six to eight months—to meet the whole of the fertiliser bill for this year's crops, a portion of it has been paid to save interest charges and to reduce the liabilities against the next crop when marketed. A similar course has been adopted in regard to purchases of power paraffin.

The balance of any sum available, or in some cases the total loan granted, has been allocated for current native

wages, to be paid in almost all cases in monthly instalments through the Land Bank.

The committee has regarded the maintenance of soil fertility on the maize farms as a national question, and wherever it has been possible by reason of the financial resources of the applicant, has used every effort to ensure that the acreage planted to maize this season will be reduced and that to green manure crops increased, while at the same time making adequate provision for the use of artificial fertilisers. In this connection it may be mentioned that without the loan many maize growers, anxious to farm their lands better, would have been unable either to green manure extensively or to use fertilisers to the extent desirable. Aided by the loan, they will be able to do so, and the soil fertility on these farms should be so improved that production at lower costs, due to higher yields per acre, will be ensured in future. The loan fund may thus in no small measure be said to have taken the place of the advances from Government to promote green manuring which have been pressed for by the Rhodesia Agricultural Union and a number of farmers' associations.

In conclusion, the committee desires to express its thanks for the ready assistance rendered to it in its functions by the banks and business firms with whom, directly or indirectly, it has had cause to communicate, and to place on record its appreciation of the evident desire of both farmers and those to whom money is owed in respect of farming operations to ensure the maximum benefit to the country from the maize loan scheme.

Geese.

By G. H. Cooper, Assistant Poultry Officer.

Geese are not exceptionally popular in Rhodesia at present, chiefly, it is thought, because there is a lack of demand, and also because in a hot climate the flesh is somewhat greasy and rich eating. However, geese can be profitable as a small side-line on the general farm, and possibly if there was a better supply the demand would also increase for good quality birds sold at reasonable prices.

An occasional gosling helps materially in adding variety to the meats on the farm and in town, and would be welcomed by the astute housewife, especially during the cooler weather.

Goose ham, smoked or otherwise, should be very popular. Again, goose feathers are most suitable for stuffing pillows, etc., and are always in demand. The usefulness of the goose cannot be denied. It is also a very excellent "watchdog."

History.—It is generally accepted that all the domestic varieties have descended from the Grey Lag. This goose is very similar to the common grey goose often met with, but is smaller in size. Of the domestic varieties the Embden is the most popular; then the Toulouse, and finally the Chinese or African. The first two mentioned derive their names from the respective towns of those names. The origin of the Chinese or African goose is obscure. It is certainly not indigenous to Africa. It may even be a fertile hybrid descended from the common swan and one of the varieties of wild geese. It certainly exhibits swan characteristics very largely.

Breeds.—*Embden.*—The most popular breed. It is a pure white colour, which enables it to dress up well for the table. It is docile, a splendid forager, sitter and mother.

Quick growth and early maturity are also characteristics of this breed. As a layer it is no better than the others, though its eggs are somewhat larger as a rule.

Toulouse.—Resembles the Embden very closely except as to colour, and it has a distinctive odour. The geese of these breeds usually lay two batches of eggs in a season, and as a rule a young goose commences to lay when from eight to nine months old.

Chinese.—Two varieties, brown (or grey) and white, knobbed, each feather of the grey edged with a pale shade, a brown stripe down the neck, fawn breast, dark brown back, wings and tail, and black beak, knob and legs.

The standards of these breeds are as follows:—

Embden Geese: General Characteristics.—

Head.—Long and straight. Bill fairly short, stout at the base. Eyes bold.

Neck.—Long and swanlike, the throat uniform with the under mandible and neck, i.e., without a gullet.

Body.—Broad, thick and well rounded; round breast, with very little, if any, indication of keel; broad shoulders and stern; long straight back and deep paunch; large and strong wings; close tail, carried well out.

Legs.—Fairly short, large and strong shanks; straight toes, connected by web.

Carriage.—Upright and defiant.

Plumage.—Hard and tight.

Weight.—Gander, 30 to 34 lbs.; goose, 20 to 22 lbs.

Colour.—Bill, orange; eyes, light blue; legs and feet, bright orange; plumage, pure glossy white.

Scale of Points.

Type (breast 20, head 12, general carriage 12, neck 10)	54
Size	20
Colour	10
Condition	10
Legs and feet	6
	100

Serious Defects.—Plumage other than white; any deformity.

Toulouse Geese: General Characteristics.—

Head.—Strong and massive. Bill strong, fairly short, and well set in a uniform sweep, or nearly so, from the point of the bill to the back of the skull. Eyes full.

Neck.—Long and thick; the throat well gulleted.

Body.—Long, broad and deep; prominent breast, deep and full; the keel straight from stem to paunch, increasing in width to the stern and forming a straight underline; broad shoulders; back slightly curved from the neck to the tail; large and strong wings; somewhat short tail, carried high and well spread; paunch and stern heavy and wide, with a full rising sweep to the tail.

Legs.—Short; shanks stout and strong boned; straight toes, connected by web.

Carriage.—Somewhat horizontal; not as upright in front as the Embden, and thick set.

Plumage.—Full, somewhat soft.

Weight.—Gander, 28 lbs. to 30 lbs.; goose, 20 lbs. to 22 lbs.

Colour.—Bill, legs and feet, orange; eyes, dark brown or hazel. Plumage: neck, dark grey; breast and keel, rather light grey, shading dark to thighs; back, wings and thighs, dark steel grey, each feather laced with an almost white edging, the flights without white; stern, paunch and tail, white, the tail with a broad band of grey across the centre.

Scale of Points.

Type (head and throat 15, breast and keel 10, tail, stern and paunch 10, neck 5, general carriage 15)	55
Size ...	20
Colour and marking ...	10
Condition ...	10
Legs and feet ...	5
	100

Serious Defects.—Patches of black or white among the grey plumage; slipped or cut wings, and any deformity.

Other Breeds.—Among other breeds of geese are the following:—African, one variety, brown (or grey), knobbed, very similar to the Chinese, but generally twice its size and weight. Canadian, one variety, chiefly fawn and brown, edged with dull white, with black bill, head, neck, rump, tail, legs and feet. Cereopsis, one variety, chiefly clear brown-grey, with dull white head, shoulders and upper part of back brown spotted, black tail, red legs and black feet. English, two varieties, grey and white, very similar to Toulouse and Embden, but generally half the size and weight of those breeds. Sebastopol, one variety, pure white, with frizzled and silky feathers on the back, wings and body, of extraordinary length, and many of them trailing on the ground.

Conditions and Feeding.—Geese are essentially grazers, and should only be kept largely where conditions facilitate plenty of grazing, especially in vleis, along rivers and in old fields, etc. Under these conditions they are more profitable and useful. Where sufficient grazing is not available, the cultivation of an area of green feeds will be found advantageous. Any of the cabbage variety of feeds, together with lucerne, oats, etc., will be excellent. Be careful not to stock such cultivated land too heavily, for the geese crop very closely, and their manure, being very strong, is apt to sour the soil, but in moderation the soil will benefit. When there is a scarcity of grazing the birds may be fed twice a day, giving on the average 3 ozs. of feed per bird. A wet mash should be fed in the morning; this may consist of bran, sunflower head meal and mealie meal in equal proportions, and its value is increased if mixed with some sour skim milk. After coming in from grazing they may be given a feed of mixed grains, such as mealies, oats, wheat, kaffir corn, sunflower seed, etc. In the morning feed may be included any table scraps of vegetables, soups, etc., and other farm produce which usually goes to waste. However, when there is ample good grazing available the feed of mash in the morning is not essential. Green food, when no grazing is available, must be given. Swimming water is not essential to geese, but the heavier varieties will invariably give better fertility when a pond or swimming water is accessible.

Housing.—Geese are not very keen on being housed in any way, but they should be made to get used to sleeping in a house, so as to avoid trouble during wet weather, and especially after plucking. It is essential to supply housing for goslings, as they cannot withstand wet weather or much cold.

The open shed type of building suits the purpose admirably, and may be made of grass thatched on to wire netting, the back and two sides being entirely enclosed and the front open except for the wire netting protection. A suitable gate must be conveniently placed in front and the roof well thatched, preferably on the half-hip principle, so as to allow plenty of sunlight to enter the house. The floor should be raised slightly above the surrounding soil to ensure dryness and be covered with ample dry grass or other litter and kept sweet and sanitary. Do not put water inside the house at night, for they will soon spill it about and make the litter damp. Fix a water tin immediately outside the wire netting front and place convenient holes for them to get their heads only through to drink. If they invariably make a noise all night, as is often the case when housed like this, a wall of sacking, sunflower stalks or similar material erected about four feet high and about the same distance from the front of the house will be found to assist in keeping them quiet. They must be liberated at dawn and shut up last thing at night, giving them a full day's grazing. Face the house north-west to afford the most protection.

The Breeding Stock.—Not all the birds in a flock, unless very exceptional, should be allowed to breed. As with turkeys, size is required, so it is advisable to eliminate any under-sized or weak birds from the breeding flock. Select only well framed birds showing strength and vitality and as near to the standard of the breed as possible. Do not inbreed closely, but obtain new blood from time to time. Only mature birds should be used for breeding, that is, from two to six years, when geese are in their prime for breeding purposes, although they often live and breed successfully when much older. The birds for breeding must be selected some considerable time before the breeding season, which is in the spring. The ganders select their own mates, and between them there appears to be a deep and real affection. They do

not forget each other easily. Should they be separated just prior to the breeding season, they will seldom breed with others that season.

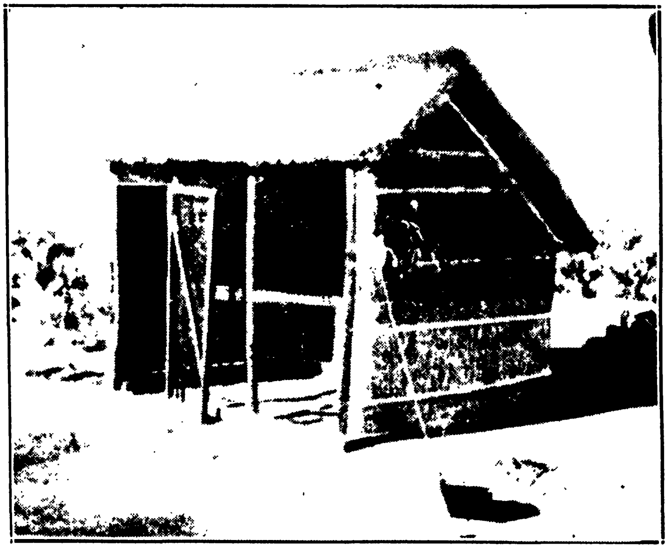
Do not separate the sexes at any time, for the ganders help considerably in rearing the goslings and have a highly developed protective instinct towards their family. Good results are obtained when the breeding birds are run as a flock, or they may be mated one gander to two or three geese. They should not be allowed to become overfat prior to the laying season in the spring, or egg production will be retarded and early goslings not forthcoming. It is convenient to make roomy nests for the geese fairly near the homestead and in secluded spots. A grass covering of the wig-wam type with an opening is excellent. Some grass and a nest egg in the nest will induce the geese to use them.

Much difficulty is often experienced in determining the sex of geese. If they are driven into a corner the ganders will usually come out to protect the geese, but to be sure of the sex the bird must be caught and gentle pressure applied around the anus with the fingers, when in the case of a male the sexual organ will protrude. The birds must be at least six months of age.

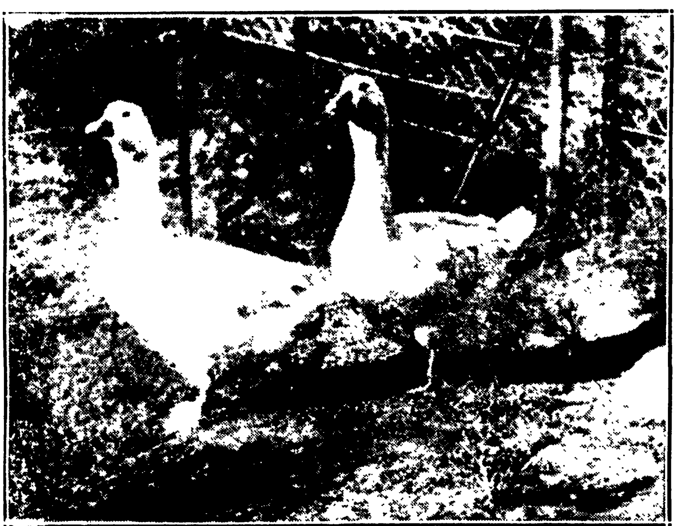
Incubation.—The usual methods of incubation may be employed with goose eggs as with other classes of poultry. The goose herself may be allowed to incubate her own eggs, or hens, turkeys and incubators may be employed. The period of incubation is 30 to 32 days. When any numbers are required, the goose should not be allowed to hatch her own eggs when she goes broody; the nest should be closed to her, and after a few days the broody fever will be broken. She will then commence to lay again.

The eggs should be collected daily and only one allowed to remain in the nest. They should be kept in a cool room and turned daily until sufficient have been obtained for sitting. Ample moisture must be supplied by pouring water once or twice during the hatch into a hole leading under the nests, or by supplying sufficient in the incubator, which should be run at a temperature of 102° F.

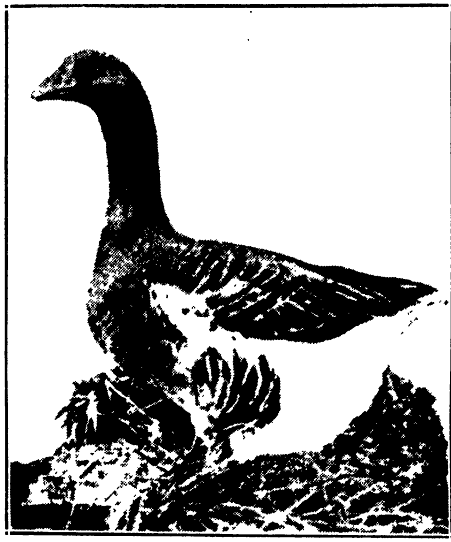
When a goose again goes broody she may be given as many eggs as she can conveniently cover and left to herself,



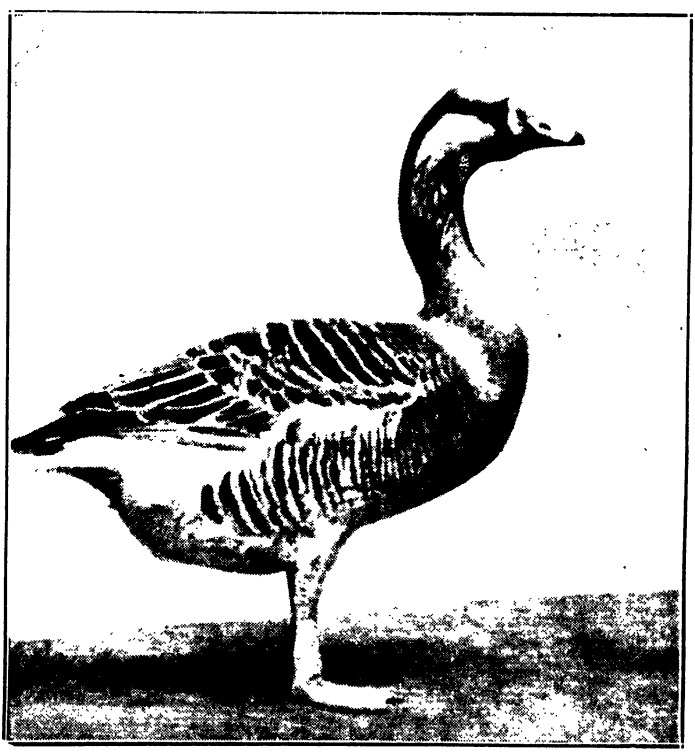
Grass house suitable for geese.



A pair of Embdens.



Toulouse goose.



The common grey farm goose.

except for testing the eggs on the seventh and eighteenth days for fertility and dead germs, as is done with hens' eggs. Infertiles and dead germs should be removed.

It is often advisable to remove the goslings as they hatch, keeping them dry and warm until the hatch is complete and then returning them to the mother; otherwise she may destroy some in excitement. However, many prefer to leave them alone, as interference may result in their doing exactly what one is trying to prevent. The individual must be studied in this respect. The gander will often resent any interference with the goose when sitting and may become vicious.

Rearing.—Goslings are invariably very hardy. When the hatch is complete and they are all dry they may be shifted with the mother to a warm, dry coop with a small run attached, and kept in this for about ten days or until they are strong on the leg, when they may be allowed to range or be given a larger run. They require no more brooding after this, and the mother may be removed if necessary, but whenever possible both she and the gander should be allowed to graze with the goslings, thus affording them much protection and help.

Goslings hatched artificially must be brooded similarly to chickens for a few days (see Bulletin No. 740) in a brooder with deep grass nest and run attached, especially during the cold wet weather. They must be allowed out in the run during the day if weather permits. After ten days, a warm, comfortable coop, and good short grazing in a large run or free range, are all they require in the way of brooding.

Goslings right from the first should have clean water and fine grit before them. For the first ten days the water receptacle should be so constructed as to allow them to get their beaks only into it.

Feeding.—Give no food for the first 36 hours, then give coarse mealie meal or oatmeal, moistened with milk and sprinkled with sand and charcoal. To each meal add finely chopped green food, especially onions or onion tops. This menu should be given for the first three days; subsequently give equal parts of bran or sunflower head meal and mealie meal mixed, preferably with milk, to a crumbly consistency;

if milk is not available, use soup. Kitchen scraps well cooked and cooked vegetables can also be added. Three meals a day should be given for the first six weeks; after this one meal, provided they can find plenty of young tender grass and food in the veld. If required soon for market, however, two meals are preferable. They are often ready for the table at three months old. Goslings should always have plenty of drinking water from the day they are hatched, but they should not be allowed to swim till they are about three weeks old. Great care should be taken to prevent their being exposed to the hot sun, for this is fatal to them. They should always, up to a fortnight, be kept in a shady run, and should not be exposed to rain or dampness. Dry bedding is absolutely necessary.

Ten days before selling the goslings should be "finished" by limiting their run and feeding on a wet mash consisting of equal parts of bran or sunflower head meal and mealie meal mixed with boiled potatoes and skim milk or soup if available. Keep the same lot of goslings together always, and do not change them about, for they are likely to fret and go off their feed, in which case they should be liberated and the finishing process started a week or so later. They must be well and warmly housed, and have ample water, grit and charcoal before them during this period.

Marketing.—As mentioned previously, there is no large market at present for geese, but anyone breeding them would be well advised to supply them to hotels and boarding houses in preference to placing them on the open market. Young, tender, fat goslings, anything from 8 to 12 lbs., supplied regularly, are likely to create the demand themselves. Too many people are inclined to think of a goose for the table as something that is too large for the ordinary family, because they have only found old tough geese on the market.

Generally the sale of birds cleaned and trussed is the more remunerative, and when done attractively they command a higher price; there is always the sale of the feathers also to compensate for the extra labour and time involved.

Killing and Trussing.—When goslings are marketed dead they should be fasted for 24 hours before killing. They may be killed by dislocation of the neck where it joins the

head, or preferably by piercing the brain with a pointed knife through the cleft in the roof of the mouth and immediately severing the veins in the throat by cutting deeply across the back of it. To perform this easily the bird must be suspended by the legs with its head on a level with the shoulders of the operator. Dry plucking must commence immediately, and is preferable to scalding, which toughens the skin and ruins the feathers. The dry plucking must be done carefully and whilst the bird is still warm to avoid tearing the skin. The bird when plucked must be properly cleaned and singed to burn off any stray fluff and to give it an appetising brown appearance. After thoroughly washing, it must be trussed. The skin of the neck must be left on, but the neck proper cut off. This skin is neatly folded over the back and fastened in position with a skewer. The wings are bent back over this and stay in position by themselves. The legs are taken off at the hock, pushed up, and a skewer put right through the bird and immediately below the thigh joints. Another skewer secures the ends of the thighs in position near the root of the tail.

For home use it should then be stuffed, thus greatly improving the appearance and flavour. The following recipe has been authoritatively recommended by others, as also the recipes for the curing of goose ham, which is the half of the goose thus prepared cut from neck to tail and cured in much the same way as ordinary ham.

Stuffing Recipe.—

Two tablespoons breadcrumbs, 1 tablespoon parsley, ½ oz. chopped suet, pinch of sweet herbs and a little grated lemon rind.

Mix all ingredients and add sufficient liquid to bind to a firm consistency. The crop cavity must be well filled, when the bird will have a full, plump appearance.

Recipes for curing ordinary ham, also recommended for curing goose ham sufficient for 50 lbs. of meat.—

(1) 4½ lbs. common salt, 1½ lbs. common brown sugar, 2 ozs. saltpetre, ¾ oz. allspice, 2¼ gallons soft water.

(2) 6 lbs. common salt, 1 lb. black sugar, 1 oz. saltpetre, ½ oz. bicarbonate of soda, ½ oz. black pepper, 2½ gallons soft water.

Mix and boil pickle thoroughly, skimming off scum until pickle is perfectly clear, and allow to cool over-night. Rub each ham with fine salt and pack fleshy part downwards and on a slant and leave over-night to drain. The next morning transfer the hams into the pickle, which should completely cover the meat. Hard wood or stone receptacle should be used, as the pickle is likely to act upon soft wood and other material and so influence the flavour of the meat. Cover the receptacle with a loose-fitting lid of the same material and weigh it down with clean bricks or stone. As it ordinarily takes about four weeks to complete the pickling of ham, goose ham will naturally take a shorter time, as it is thin and not so bulky. If the hams are closely packed, their positions should be changed at intervals of five to seven days, placing those on top at the bottom and *vice versa*. After the pickling process the hams should be thoroughly washed in tepid water and hung up to drain over-night. The following morning they should be wiped dry and be ready for smoking. Curing should be done in a cool and dark room or cellar, and, needless to say, strictest cleanliness must be observed.

Plucking.—The birds may be plucked every six to eight weeks, although it is better done not quite so frequently. The growing of new feathers is a severe tax on the bird's strength, and breeding birds should never be plucked a few months before or during the breeding season. Where plucking is practised, it is advisable to house the birds well and give them extra attention with regard to feeding to enable them to withstand it better.

Only the breast and paunch feathers should be plucked, and are best graded in their two distinct qualities (fine and coarse) and kept separately. Plucking must be done indoors and on a clean floor, where stray feathers may be swept up.

The Camelthorn
(*ACACIA GIRAFFÆ*, BURCH).

By J. S. Henkel, F.R.S. (S.Af.).

One of the interesting trees found along the western border of the Colony of Southern Rhodesia is the Camelthorn (*Acacia giraffæ*, Burch). The native name is "mwohlo."

The camelthorn occurs extensively in Bechuanaland and appears to extend eastwards into Southern Rhodesia as far as the Shangani River in the north and Shashani and Shashi Rivers in the south. The tree is usually found on deep alluvial soil along river banks and on edges of vleis in the Kalahari sand areas, where it sometimes forms dense thickets. It is, however, not infrequently found as isolated trees or groups of trees away from the vleis, but always on deep soil.

In the Wankie game reserve the tree is frequently met with, and where there is a good supply of water trees having boles up to four feet in diameter are found.

The camelthorn pods are a favourite food of almost every species of game. Eland, elephant and giraffe are specially partial to the pods, while giraffe browse on the leaves.

The tree is easily recognised by its pods, which are covered with a dense grey felt. The pods are oval-sickle shaped and about 4 ins. long, about 1½ ins. wide and ⅓ in. thick. The pods remain closed and contain spongy tissue, in which the seeds are arranged in several rows.

The tree has a short bole and spreading crown. The twigs are armed with stout, brown, stipular thorns. The leaves are compound, smooth and with one to three pairs of pinnæ. The pairs of leaflets on each pinna range from 10 to 15. The flowers are yellow in globose heads and appear in early spring.

When felled, the tree coppices freely and also multiplies by root suckers. It is spread by animals eating the pods and voiding the seed in the excreta. On the Kalahari sand areas the writer has frequently noted seedlings which have developed from seed in the excreta of elephants.

With the object of testing the food value of the camelthorn pods a supply was collected on the Wankie Game Reserve and submitted to the Chief Chemist of the Department. His report on the food value is as follows:—

"The analysis of the camelthorn pods recently carried out in this laboratory indicated that they should prove a valuable supplement to diet of grazing cattle during the dry season, as they were found to contain fairly large quantities of certain essential food constituents that are particularly deficient in the grazing during the winter months.

It is interesting to compare the analysis of these pods with veld grass sampled at the time of year that the pods were collected. It will be seen from the following data that the acacia pods are lower in fibre and very much higher in protein and acid-soluble minerals than the veld grass.

	Acacia pods.	Veld grass.
Moisture	9.4	9.0
Acid soluble ash	3.3	1.9
Ether extract	1.6	1.0
Fibre	31.0	40.3
Crude protein	11.4	1.8
Lime	0.9	0.4
Phosphoric oxide	0.24	0.15
Potash	1.3	0.7

The value of these pods as a supplementary food to grazing cattle is readily apparent when one considers for a moment the maintenance requirements of a resting animal of, say, 1,000 lbs. live weight. The minimum amount of digestible protein required by such an animal for maintenance purposes alone is approximately ½ lb. per day. If we assume that 50 per cent. of the total crude protein contained in veld grass during the winter months is digestible (the percentage is probably considerably in excess of what the actual digestibility would be), it will be seen that the animal would need to consume over 50 lbs. of the dried grass, which is equivalent to just over 45 lbs. of dry matter, in order to

obtain its minimum maintenance requirement of protein. As the capacity of the average animal of 1,000 lbs. live weight is only in the neighbourhood of 25 to 30 lbs. of dry matter per day, it is clear that the average veld grazing during the winter months is too deficient in protein to supply even a resting animal with its requirement.

It will be seen from the above analytical data that the crude protein content of the acacia pods is over six times that of the veld grass, and when this is coupled with the fact that the digestibility of the protein in the pods would probably be somewhere about 70 per cent., it is possible to assume that they would prove a valuable supplement to animals entirely dependent upon the veld grazing for their sustenance.

It is also quite probable that the low mineral content of the veld herbage during the dry season exercises an adverse influence on its nutritive value, and the addition of the acacia pods to the animal's grass diet would increase its mineral intake, thereby exercising a favourable influence on the general nutrition of the animal."

If the tree is not present on farms in Matabeleland it may be introduced by feeding the ripe pods to cattle just before the summer rains commence. The seeds will be dropped in the excreta of the cattle, and if a favourable rainy season follows, numerous seedlings will result.

The tree has a very long tap root. Many years ago, when studying the tree in the Vryburg district, examples of roots penetrating to a depth of 80 feet came to the notice of the writer.

The Training of Pointers and Setters.

By Duncan K. Smith, Marandellas.

On most farms in Rhodesia game is more or less plentiful, and the writer suggests that the "pot" could be kept boiling and much valuable time saved if farmers kept a trained dog. Often it is a tiring and almost impossible thing to get a little fresh meat on outlying farms, with a gun, unless a trained dog is used. It is always possible to find a brace of birds or a small buck in very much less time than the uninteresting and tiring method of walking them up if a trained dog is available.

Pointers and setters can be trained to work on game birds and small buck equally well. The time required for the training of a dog is very little, and most of the spade work can be done in a few minutes after work each evening in the back yard, and the trouble so taken is very well repaid. The writer will be pleased to answer any questions that may arise in the course of training. If the following instructions are carried out the training will be found to be efficient and remunerative.

Do not be sparing in your praise when the puppy shows signs of willingness to obey a command. Make a great fuss of him, show him that you are pleased with his progress. Do not at any time continue his lessons for long enough to tire him, or he soon loses interest. Try in every way to gain the confidence of the dog; all training will then be made comparatively easy. Encourage your puppy to hunt about ahead of you when taken for walks, etc. Do not on any account lose your temper when putting a puppy through his paces; rather put off a lesson when feeling a bit tired or irritable, as unreasonable treatment, which must follow the loss of temper, greatly baffles the puppy; often much good work is undone in this way.

It is hoped that the following notes on the handling and training of gun dogs (pointers and setters) will be of some use to those sportsmen who have not had much experience in the training of gun dogs and who wish to do their own training.

It is not the object of this article to go into the relative advantages of pointers or setters. Whichever breed is chosen, given fair treatment, will more than justify the trouble of training.

A few points on the choice of material on which to commence work will not be out of place here. Whichever breed is favoured, obtain the best your means will allow of that breed and stick to it; do not be tempted to use cross-bred dogs. The reasons for this are that the stock from cross-bred dogs are of no value and cannot be relied on to reproduce true-to-type offspring. A pure-bred dog costs no more to feed and is much more easily broken to his work, and should he turn out exceptionally good, would probably prove profitable to the owner.

Choose your puppy from a working strain, and if possible from a strain that has come out well at field trials. The secretary of the Salisbury Kennel Club would, I feel sure, furnish particulars of breeders whose dogs are run at the local field trials each year, and awards, to any interested sportsman. The writer would suggest that a puppy of four months would be suitable on which to commence training.

Obedience should be the first aim of the handler, but care must be exercised in the attaining of this virtue not to bully the puppy. Kindness and firmness will be found to answer best. The writer finds that once the puppy is sure of what is required of him, he will willingly give of his best (with occasional lapses).

You cannot begin to make your puppy hunt close too soon. This can be greatly aided by throwing small pieces of boiled meat, etc., into some cover, such as short grass, etc., where the puppy must use his nose, not his eyes, to find the tit-bits. It soon will work hard to find the scraps, and the exercise can gradually be made more difficult. A little raw meat can with advantage be trailed along the ground for some distance and hidden in a patch of grass; the puppy is shown the "trail" and encouraged to "work

it out." Use the same word each time, so that the puppy will become accustomed to the word "seek" or "find it," and later on he will know what is required of him on hearing the word.

At feeding time make the puppy "steady" before he is allowed to partake of his meal. A gentle tap on the nose will generally be found to be sufficient, or if necessary the pup can be held away from the food for the first few lessons. Use the word "steady" several times during each lesson; after a reasonable time has elapsed, allow the puppy to go to his food, using the words "good dog."

Teach your puppy to "drop" to command. The best way to commence is to use the word "drop" fairly sharply, and, by placing the hand on the shoulders, with a downward and backward pressure force the puppy to the ground, where he must remain until the words "hold up" are given, when the pup is allowed up and rewarded with some tit-bit. After several lessons the puppy will "drop" to command. When the "drop" to command is obeyed without hesitation, get the pup to drop to signal. At first raise the hand above the head and lower forwards sharply, using the word "drop"; gradually reduce the tone of voice used for the "drop," so that in time the puppy connects the movement of the arm rather than the sound of the voice with his "drop." Gradually reduce the forward movement of the hand until the pup automatically drops when the hand is raised above the head.

Do not spare any pains in getting your pup proficient in these exercises; they are all most necessary for his future success. The reasons will be given in the next article, which will also deal with the training of retrieving and the first stages of field work.

(To be continued.)

Rhodesian Coffee from Chipinga.

REPORT ON SAMPLES SUBMITTED TO EUROPEAN IMPORTERS.

Sterkstroom, C.P.,
2nd December, 1930.

To the Minister of Agriculture and Lands,
Salisbury, S. Rhodesia.

Dear Sir,

When I visited my son in September last, who is farming in the Melsetter district, I obtained a sample of coffee (Blue Mountain) grown by Mr. Parkes near Chipinga village, and on my return here submitted it to the Nectar Tea & Coffee Co., Capetown, for a report. This they supplied, and they in turn sent the sample to Messrs. H. E. van Ysendyk Jn., Rotterdam and Antwerp, for whom they act as South African agents, asking for their opinion.

As I feel sure it will be of interest to your Department, I am herewith submitting copies of both the reports to you, and you will be at liberty to make what use you wish of them.

In the Johannesburg "Star" of the 28th November an article on "Coffee-growing in Rhodesia" appeared, which is part of the report supplied by the Nectar Tea & Coffee Co., and evidently got into the hands of the Chipinga correspondent of "The Rhodesia Herald" through my son, to whom I sent a copy.

You will note that Messrs. H. E. van Ysendyk rank the Chipinga coffee amongst the best that can be procured, and we would just add that best Central American coffees are being offered in the Union markets at about 52s. to 56s., which is considerably less than what Chipinga is valued at on the Continent. I might mention that I am now waiting for a sample of tea from the Tanganda Tea Estates (Ward and Phillips), Chipinga, to supply the wants of the Nectar

Tea & Coffee Co. I also intend sending samples of tea and coffee to Messrs. J. Lyons & Co., caterers, London, with a view to interesting them in the Melsetter district.

Might I suggest that these two reports be published in detail in the *Rhodesia Agricultural Journal* as a contribution by Verran Bros., of Sterkstroom and Chipinga, or do they not accept such items?

Thanking you,

Yours faithfully,

G. W. VERRAN.

Messrs. Verran Brothers,
Sterkstroom.

Dear Sirs,

We herewith confirm our letter of the 30th ultimo.

We have read your communication, as per your letter of the 26th ultimo, on the subject of coffee-growing in Rhodesia with interest, and we are very much impressed with the cup quality of the coffee, of which you have sent us a sample.

We import ourselves annually a certain quantity of coffee grown on the slopes of the Kilimanjaro, and we had occasion to compare your coffee with samples just received of the new Kilimanjaro crop.

Both coffees are very much alike when roasted, and we do not know which one we prefer for cup value; in our opinion the Kilimanjaro is slightly better, but we admit that European experts might prefer the Rhodesian-grown variety. Your coffee is a "difficult" roaster, and when roasted not as agreeable to the eye as Guatemala or Columbia or some other Central American coffees are. This applies to our Kilimanjaro coffee as well, which is also a difficult roaster. It is to a certain extent a drawback, because it necessitates blending after roasting, and this method spoils the appearance of the blend if the composing coffees are not of equal colour. The consumers of coffee in the Union are, generally speaking—and sorry to say so—not very particular as regards quality as far as coffee is concerned, but the European consumers are less easy to satisfy, and the European roasters do not favour the idea of blending the coffee after roasting—they rather blend the raw coffees.

We are posting you, per same mail, a sample of your coffee, blended before roasting with some other growths. Close examination will show you that part of the beans are well developed and that part of the beans should have had the heat a little bit longer. The roasting has been done in a small coffee-roasting plant, and will improve if done in a big, modern, coffee-roasting plant.

We note your remarks on the cleaning of the sample sent to us, but we kindly ask you to let us know whether the cleaning has been done entirely by machinery, or otherwise how the parchment and silver skin has been removed. We take it that the coffee has been graded, although the regularity of the beans could be improved upon; there is also a small percentage of faulty beans present. This affects the market value of the coffee—in particular in those countries where the consumers buy coffee in the whole bean. We are posting you a sample of Central American coffee for comparison.

Finally we are sending, by this week's mail, samples of your coffee to our friends, H. E. van Ysendyk Jn., Rotterdam and Antwerp, for their expression of opinion.

Yours faithfully,

The Nectar Tea & Coffee Co., Ltd.

N.B.—The sample was entirely ungraded, just as it came from the trees.—G. Verran.

Capetown,
24th November, 1930.

Messrs. Verran Brothers,
Sterkstroom.

Dear Sirs,

We received your letter of 22nd October, contents of which had our attention.

Our European friends have expressed their opinion as follows:—

Messrs. van Ysendyk, Rotterdam, say:—

We are in receipt of your letter dated 9th October, as well as the sample of Rhodesian coffee, which we have roasted and tasted. It interests us very much to see that

even Rhodesia opens possibilities for coffee-growing, apparently with success. We consider this coffee is a superior one; the roast is very good indeed and the cup quality the same. We estimate the quality to be about the same as Costa Rica coffee, and this coffee will no doubt find a market in London, Holland or Hamburg.

The present market value may be, after our opinion, about 56 to (t) 58 cents, taking into consideration that we bought some days ago a nice Guatemala (new crop) from a first-class plantation at 53 cents.

(56 to (t) 58 cents means per ½ Ko., which is about 93s. per cwt.)

Messrs. van Ysendyk, Antwerp, say:—

Rhodesian Coffee.—We cup-tested the sample sent to us and compared the quality with Guatemala coffee, Columbian, Caracas, East Indian and Kilimanjaro coffees. The taste is nearest to a parcel of Guatemala coffee which we have in stock at present. The roasted appearance, however, is not equally nice, the Rhodesian beans being slightly deformed, which perhaps is a question of more careful cultivation. As regards price, we may mention that Guatemala extra choice, also the best coffee of this kind that exists, as well as regards appearance or taste, is quoted 82s. 6d. per 50 Ko. Very fine Columbian coffee, which substitutes the Guatemala advantageously, is quoted 80s. per 50 Ko.

Comparing their opinion with what we wrote you on the 9th October, we find that Antwerp agrees with us so far as roasted appearance of Rhodesian coffee is considered. Rotterdam's valuation is about 10s. per 50 Ko. above Antwerp's, and considering that we have recently offered to pay a price for new crop Kilimanjaro coffee equal to 95s. for 50 Ko. c.f. Capetown, we feel inclined to agree with the Rotterdam valuation.

Referring to your letter of 22nd ultimo, we see that tea planters in Rhodesia claim their tea to be self-drinking, which requires no blending. We should be greatly obliged if you would send us a sample for comparison reasons.

Yours faithfully,

THE NECTAR TEA & COFFEE CO., LTD.

Locusts in Southern Rhodesia.

By RUPERT W. JACK, Chief Entomologist.

Reports of locust swarms in Northern Rhodesia and part of the Wankie district in this Colony at the end of November and beginning of December have caused some anxiety to the farming community, and it appears desirable to acquaint the public with the position. The opportunity may also be taken of giving a short account of the general locust position in reference to this Colony.

Southern Rhodesia in the past has suffered less from locust outbreaks than many other African States. A very serious invasion by the brown locust occurred in 1924, but previous to that year no real trouble with locusts had been experienced since the year 1908, although swarms were still in the Colony in 1909 and 1910. Locusts had been prevalent several years previous to 1908.

There are two species of locusts known periodically to swarm over Southern Rhodesia. These are the Brown Locust (*Locusta pardalina*) and the Red-winged Locust (*Nomadacris septemfasciata*). In addition, a third species, namely, the Migratory Locust (*Locusta migratoria* f. *migratoricides*), has been recorded as having entered the Colony from the east, namely, in September-October, 1923. These swarms, however, failed to lay eggs within our borders, as far as is known. The brown and the red-winged locusts, on the other hand, do lay eggs in abundance in Southern Rhodesia during periods of outbreaks, and it is the immature or "hopper" form of these insects which tends to cause the greatest damage.

In order that the position in regard to outbreaks of migratory locusts may be understood, it is necessary to state that, according to recent research, migratory species have two forms, or, as they are termed, "phases," the one being

termed the solitary phase and the other the swarm phase. In the solitary phase the locust is nothing more than a grasshopper living in solitary life, as do other species of this family which are not addicted to swarming. Localities where the solitary phase occurs continuously may be regarded as natural homes or permanent haunts of the species concerned.

In the swarm phase the insect usually differs in coloration, and also to some extent in form, from the solitary phase. The swarms which leave the natural home and breeding grounds of the species range far and wide for hundreds of miles, but the country then invaded does not necessarily provide conditions under which the insect can live and reproduce in perpetuity. They are merely areas subject to temporary invasion.

It is not necessary here to deal with the causes which lead to increase in numbers of locusts and the migration of vast swarms from the permanent breeding grounds. These causes are in fact still imperfectly understood. It is, however, necessary to realise the relation between natural breeding grounds and areas liable to temporary invasion in order to understand the position of Southern Rhodesia in regard to locust outbreaks.

The Brown Locust.—The brown locust is an inhabitant of the dry Karroo areas of the Cape, the north-western parts of the Cape Province, the western portion of the Orange Free State and adjoining areas. Here, as has been shown by Professor Faure, of the Transvaal University College, this species occurs in the solitary phase. The solitary phase has also been found in certain areas in the Kalahari region, being associated, according to Professor Faure, with lime patches. It is not known whether swarms are built up in these areas, but swarms are certainly built up in the Union. It is practically certain that no permanent breeding grounds of this species are to be found in Southern Rhodesia. Southern Rhodesia seems in fact to be only an occasional overflow area for this species.

In the permanent breeding areas of the brown locust in the Union, and in areas adjacent thereto, these insects tend to appear in swarm formation almost annually, but since the last cycle of great abundance, which ended in

1925, the swarms have not been large or numerous enough to be beyond the control of the locust administration in the Union.

In the past, outbreaks of the locust have been generally attributed to breeding up in numbers of the insects in the Kalahari Desert region, and it certainly appears that this area plays a very important part in reference to these outbreaks. There is at present, however, no direct evidence that swarms are primarily built up in the Kalahari, and according to one theory the Kalahari may need to be invaded by swarms from the permanent breeding grounds in the Union before a cycle of great increase can commence. The locust administration in the Union is therefore constantly on the alert to destroy any swarms which appear in the Karroo and adjoining areas, in the hope that by preventing escape of swarms to the Kalahari region they may be able to keep this potential pest in a constant state of repression—that is to say, under control. The inhabitants of this Colony will have reason to be grateful if these efforts are successful.

The normal course of events leading up to an invasion of our Colony by this species may or may not be faithfully illustrated by the locust history of the years preceding the invasion of 1924. There are not sufficient records on which to base a conclusion on this point. The sequence of events may, however, be typical.

The last brown locust cycle in the Union had more or less subsided by the year 1911. Locusts continued, however, to give some trouble year by year in the Cape Midlands and the south-western portion of the Orange Free State. Some years were much worse than others. In the season 1915-16, for instance, locusts were reported as more numerous than in any year since 1909-10. During the two seasons 1918-19 and 1919-20 no swarms of hoppers were reported, although the insect was observed in the solitary phase in its permanent breeding grounds. Hoppers in swarm formation appeared again in 1920-21, and the winged swarms later spread far and wide, some penetrating even to Natal. This proved to be the beginning of a very widespread outbreak. Up to the 1921-22 season the insect had apparently kept south of the Transvaal, but that province was entered in-

January, 1922, and during that season the pest also appeared in the Bechuanaland Protectorate. During 1922 this insect penetrated the south-western portion of Southern Rhodesia, a few winged swarms being reported from May to July in the districts of Gwanda, Bulalima-Mangwe, Mtoko, Umzingwane, Bulawayo, Nyamandhlovu. No subsequent hatchings of hoppers were, however, located.

By the season 1922-23 this locust was in evidence over a vast area stretching from Northern Bechuanaland to the southern Cape, and including the South-West Protectorate, the Transvaal, Orange Free State and Basutoland. Southern Rhodesia was apparently not entered in 1923, but winged swarms crossed from Bechuanaland into the Wankie district in February, 1924, and hoppers were reported as prevalent over the whole western portion of the Wankie district in late March. At this time hoppers were also known to be exceedingly abundant west of our border in Bechuanaland. Towards the end of April, 1924, flying swarms began to enter the Colony from Bechuanaland, and it was soon evident that a serious invasion was in progress. Great swarms gradually spread over the Colony, penetrating to the extreme north-east in the Mrewa and Mtoko districts. Practically the whole of the Colony was over-run, with the exception of the Wankie, Sebungwe, Lomagundi, Mazoe and Darwin districts in the north and the Melsetter district in the east. It is noteworthy that the districts constituting the extreme range of the flying swarms—namely, Mrewa and Mtoko—were the scene of egg-laying on a vast scale.

The eggs hatched with the first rains, and the season, as it happened, proved to be a very wet one. Owing to the intensive campaign waged against them, only a small fraction of the hoppers which hatched reached the winged stage. This event occurred towards Christmas and was followed in a few days by migration of the winged locusts westward into Bechuanaland. No locusts of this species have since been seen in the Colony.

We have therefore a picture of the locust confined for some years to its own home and then gradually gathering momentum and spreading further afield, the expansion of its range culminating after several years in a heavy invasion

of Southern Rhodesia, a country which appears to be near the limit of the extreme range of this species.

An outbreak lasting only one season appears to be unusual even in Southern Rhodesia, judging by the fragmentary records of the past, but the phenomenon appears to be explicable on the basis of certain known facts. In the first place the brown locust is essentially an inhabitant of a dry climate and is apparently incapable of perpetuating itself indefinitely in areas which are favoured with a good summer rainfall. The exact explanation of this disability is not certain, but very probably it is at least partly due to susceptibility to disease under humid conditions. According to native and other reports, it is the regular habit of this species to fly westward into Bechuanaland as soon as the brood of hoppers which hatches out with the spring rains attains wings. This instinct tends obviously to carry the insect from a more or less humid environment to what are normally appreciably drier surroundings. Unfortunately for the locusts, the season 1924-25 was an abnormally wet one, even in Bechuanaland. The winged locusts would lay eggs about February and then would hatch in a few weeks under moist conditions. The Union locust officers in Bechuanaland reported definitely that the disease *Empusa grylli* was devastating the swarms in April, 1925. According to available reports, swarms, presumably in part the offspring of those which left Rhodesia and the Northern Transvaal about Christmas, 1924, flew southward through Bechuanaland during March, thus moving, it may be noted, in the direction of what is normally still drier climate. Swarms entered the north-western districts of the Cape during April. No locusts are known to have flown eastward into Southern Rhodesia.

The usual experience in the past, when this locust has spread as far afield as Southern Rhodesia, has apparently been for flying swarms to re-enter the Colony from Bechuanaland during the winter months for several years in succession. The explanation best fitting known facts of their failure to do so in this instance would seem to be that climatic conditions inducing disease, aided by the efforts made to destroy the hoppers, rapidly reduced the locusts to a remnant in the northern areas. It is a curious fact that

the whole tendency of movement in Bechuanaland during the early months of 1925 seems to have been in a southerly direction. By June, 1925, the Union locust officers operating in Bechuanaland reported the territory practically clear of locusts, except in the extreme southern districts. All remaining locusts in the Ghanzi district and Ngamiland were definitely reported to have died of disease. By the end of 1925 it was clear that this species was once more practically confined to its permanent home. This is, roughly speaking, the position at the present day, and as yet there is no indication of any tendency on the part of the pest to get beyond the control of the Union locust administration. The Kalahari region would, however, appear to constitute an uncertain factor.

Life History of the Brown Locust.—The brown locust, in common with other locusts, lays its eggs in what are known as "pods" in the soil. Each pod may contain about forty eggs on the average (Faure). The number of pods laid under natural conditions by a female is not known. The average number of pods obtained from females kept under abnormal conditions in cages by Faure was five pods per female, although as many as fourteen were obtained from some specimens. Eggs are commonly laid during the dry season and do not hatch until the ground is wetted by rain. Thus, during the 1924 invasion of the Colony, egg-laying extended from July to September, the eggs hatching from September onwards, according to the evidence of rainfall, the bulk of the hatching occurring during October. Eggs kept under dry conditions in Capetown a number of years ago hatched out when wetted after three and a half years (Lounsbury).

The shortest incubation period for eggs obtained by Faure in out-door cages was fifteen days. This was under moist conditions.

The young locusts are of course destitute of wings and do not obtain these organs until after the last "moult," when the hopper reaches the adult stage. It takes from six to eight weeks from the time of hatching for the locust to reach the flying stage. This previously accepted estimate was borne out by experience in Southern Rhodesia during the 1924 outbreak.

Notwithstanding certain doubts expressed in reference to this point, it appears evident that this locust in the swarm phase normally passes through two generations during the year in a climate like that of Southern Rhodesia, providing, of course, that the rainfall is more or less normal.

Flying swarms, as has been stated, lay eggs during the dry season and the eggs hatch with the rains, the resultant hoppers reaching the winged stage in December. As these fliers have so far left the Colony, it has not been possible to observe the next process of egg-laying, but in February, 1923, flying swarms entered the Wankie district and laid eggs which hatched in March. The resultant winged locusts appearing in May would thus constitute the swarms generally recorded as on the move in the winter. Reports from Bechuanaland early in 1925 showed that egg-laying during the rains must have taken place on a large scale. Faure judges that in some years and localities with very early rains this species may pass through three generations in the year.

The general position in regard to Southern Rhodesia appears to be that the Colony is subject to dry season invasions by flying swarms from Bechuanaland, that only one generation is normally passed through in the Colony during the year, that the locusts which reach the winged stage in December fly westward into Bechuanaland, where eggs are laid, that the resultant locusts reach the winged stage in April or May, and that, if no catastrophe has overtaken the insect, winged locusts tend to swarm over the Colony again from April onwards. In the meantime, of course, breeding by swarms which have not left Bechuanaland may be expected to have continued, so that destruction of the vast majority of the hoppers which hatched in this Colony in 1924 cannot be claimed as explaining the lack of an invasion in 1925. As already stated, suppression of the outbreak by disease after a single year's overflow into Southern Rhodesia must be regarded as exceptional. This Colony was invaded by the brown locust each year from at least 1906 to 1909, although the invasions in 1908 and 1909 were very light.

The Red-Winged Locust.—Unlike the brown locust, which is, or is supposed to be, a purely South African species, the red-winged locust is known to occur from the lower course of the Congo River in West Africa to the Southern

Sudan and Abyssinia to the east, and thence southward to the Union of South Africa. It is regarded as swarming mainly in the coastal belt of Portuguese East Africa and Natal, and the swarms spreading thence on to high veld of the Union and Southern Rhodesia.

It will be noted, therefore, that present primary appearance of this species in swarm formation in North-Western Rhodesia constitutes something of a new record.

The solitary phase of this species is known from Uganda, the Congo, Rhodesia and the Transvaal, and also from Madagascar, Reunion and the Comoro Islands.

Life History of the Red Locust.—Our knowledge of the life history of this species is very imperfect, but from records in the Union of South Africa there appears to be only one generation in the year. The adult locusts pass the winter in a sexually immature state, and in the swarm phase pair in the spring. It is at this period that far-ranging migrations take place. Early December is considered the usual time for egg-laying in Natal. The hoppers take about two months to reach the winged stage after hatching out from the eggs.

It will be noted from the above that the danger of primary invasion with this species seems to be confined to the spring, and that once egg-laying has been completed in December the locality of the hopper outbreak is determined for the entire year. In the case of the present appearance of flying swarms, there is every reason to hope that this locality lies outside the borders of Southern Rhodesia.

It is now over twenty years since this species of locust gave serious trouble in Southern Rhodesia, and it must be admitted that its re-appearance in swarm formation appears to be overdue. From 1906 to 1909 it was associated with the brown locust in this Colony, infesting also the Eastern Transvaal, Orange Free State and Natal, and extending in some years southward along the east coast of the Cape Colony. The insect was also present in Portuguese East Africa during this period, but the record of its distribution appears to be fragmentary. It is noteworthy that whilst there were records of flying swarms as far west as Wankie in Southern Rhodesia between 1909 and 1910, no information appears to be available of their occurrence during this period.

in North-Western Rhodesia, where such swarms have appeared during the present year. At the present time there is no information concerning the occurrence of swarms of this locust in either Portuguese East Africa or Natal.

It is, of course, to be realised that, failing reliable information from neighbouring States concerning movement of swarms of the red-winged locust, the warning of an impending outbreak might be very much shorter than in the case of the brown locust. The latter species enters during the dry season, and, as the eggs do not hatch until the rains, several months' warning is given, and this allows ample time to prepare for a campaign. In the case of the red-winged locust, the insects may cross our borders in the spring and commence egg-laying almost immediately. The fact that the eggs hatch in thirty days at this time of year leaves comparatively little time for preparation.

The inter-state intelligence system in reference to movements of locust swarms has, however, been greatly improved of late years, and warning of menacing developments in neighbouring states and even further afield can be relied upon. An odd swarm or two might conceivably escape notice in uninhabited country, but any appearance of flying swarms on a large scale would, of course, be reported at once. Swarms of flying locusts are, fortunately, highly conspicuous.

The purpose of this article is to acquaint the agricultural community with the general position in reference to locust outbreaks in Southern Rhodesia, not to deal with repressive measures; but in view of the possibility of damage from flying swarms, a few words on protection of crops from this insect will not be out of place.

In the first place it is to be realised that in a country such as this Colony it is not practicable to conduct a campaign with the object of destroying winged locusts. The movements of these insects cannot be foreseen nor their resting places anticipated. It appears, in fact, to be more or less generally agreed that attempts to attack locusts in this stage, even in country much more open and easily traversed than our forest-covered Colony, involves great expense which the results achieved do not justify.

The only practicable procedure is for each farmer to attempt to keep these insects from settling on his crops or fruit trees. The experience is that this is considerably more readily achieved in the case of the red-winged locust than in the case of the brown locust.

Most people are aware of primitive methods used by natives and others to keep a threatening swarm of locusts on the move. These include banging of tins, discharge of firearms and other methods of creating a noise, together with waving of flags made of bright coloured fabric. The best effect is likely, however, to be obtained by means of smoke smudges. The following is therefore reprinted from Bulletin No. 516 of October, 1924:—

"Materials for producing quick smudge fires and maintaining these for some hours should be collected and kept in position around the lands, with special attention to the side towards the prevailing wind; but other sides should not be neglected. Further material, which on burning gives off a pungent smoke, should be placed in readiness when there is reason to fear a visitation at short notice. Green wood with leaves attached will probably be the most readily available material of this description, but of course anything which can be added to render the smoke denser and more foul-smelling is an advantage. In the South African Union the following formula for a chemical smudge has been recommended:—

Saltpetre	30 parts
Sulphur	12 parts
Borax	8 parts
Coal tar	25 parts

"The saltpetre, sulphur and borax should be in fine powder or should first be ground; they should be thoroughly mixed, and then added to the tar (warmed if necessary), and thoroughly incorporated therewith.

"A deep tin, such as jam or coffee tin, should be filled three-quarters full of the tar mixture, and on the top of this should be placed a layer of about a quarter of an inch deep of priming mixture of the following composition:—

Saltpetre, sulphur and borax mixture as above	2 parts
Sugar, fine white	1 part

"In compounding this mixture it is essential that the saltpetre should be thoroughly dry; it is apt to absorb moisture from the air, and should therefore be dried in an oven and allowed to cool before mixing. In the centre of the priming composition a small quantity (just a pinch) of chlorate of potash (finely powdered) should be sprinkled, as this will enable the mixture to be ignited without any trouble. A few strings of cordite or gunpowder out of a cartridge could be used for this purpose. As soon as the priming composition is ignited, a lid of some sort can be put over the tin loosely. The priming mixture should burn fiercely, and in about 30 seconds a dense smoke should be produced; an ordinary jam tin, holding 1 lb. of mixture, will burn about 12 minutes. If the mixture starts into flame, a few handfuls of sand should be thrown over it to stifle the flames. There is no likelihood of it being extinguished when once fully ignited. It is of the utmost importance that the priming composition should be thoroughly dry.

"It may be stated that tins of material for producing smoke smudges for the purpose of warding off locust swarms can be purchased, ready charged, in the Colony."

In writing the foregoing article the writer has referred freely to the following, namely:—

(1) "Locusts and Grasshoppers," by B. P. Uvarov.

(2) "Life History of the Brown Locust," by J. C. Faure.

(3) Annual Reports, S.A. Central Locust Bureau, 1907-10.

(4) Departmental Reports, Locust Administration, Union of South Africa.

Enkeldoorn's First Wheat Exhibition.

The wheat growers of the Enkeldoorn and Umvuma districts are to be heartily congratulated on the success of their first exhibition of winter cereals, which are such a feature of the farming activities of this area. The exhibition was organised by Mr. C. M. Fletcher, the Civil Commissioner and Magistrate, to whose initiative the venture is due. The principal exhibit was wheat, but barley, oats and rye were also represented to a smaller extent. In reviewing the position of wheat growing, the Minister of Agriculture and Lands, who opened the exhibition, stated that in 1921 as many as 28,000 bags of wheat were grown as a winter crop in this district; and although this figure had subsequently declined, it was again on the up grade, due very considerably to the rebate granted by the Government on imported wheat, provided a quota of Rhodesian wheat were used in milling. Substantial prizes had been provided, and the cup presented by Lieut.-Col. Guest, M.L.A., for the best exhibit, judged on points, was won by Mr. J. Harvie, Harvieston, Enkeldoorn; while the special prize of £5 5s. for the best bag of milling wheat, offered by the Rhodesian Milling & Manufacturing Co., was won by Mr. E. Hallam, Lovedale, Umvuma.

It is sincerely to be hoped that this first venture will be followed in the future by similar periodic exhibitions, which cannot fail to stimulate production of an article the bulk of which is still being imported, and to improve the varieties and quality so that the necessity for extraneous varieties for blending may largely be obviated.

Matopo Nursery.

TRANSPLANTS FOR SALE.

9s. 6d. per hundred is charged for forest trees, 25 in a tin, to cover railage and loss of tins. Free at consignee's station anywhere in Rhodesia. Further particulars may be had on application.

FOREST TREES.

Botanical name.	Common name.	Remarks.
Callitris calcarata.	Black cypress pine.	Grows on poor acid soils. Useful for ornament and shelter belts. Drought-resistant. Handsome tree.
Callitris robusta.	White cypress pine.	Rather a slow-growing tree, but reaches a fair size. Suited for dry country planting. Does well in sandy soil, also in heavy loam. To a certain extent drought-resistant and frost-hardy. Resistant to white ants. Ornament and shelter. Timber a durable soft wood.
Casuarina leptoclada.	Beefwood.	Finally tall. Suitable for avenues and shelter belts. Requires deep soil.
Casuarina suberosa, var. leptoclada.	Beefwood "she oak."	Finally tall. Requires deep soil. Good shade tree. Avenues and shelter belts. Both varieties stand lopping.
Cupressus arizonica.	Arizona cypress.	A hardy cypress. Requires well drained and rather deep soil. Grows equally well on the poor sandy soil as on the heavier loam. Shelter belts, ornaments and hedges. Medium-sized tree. If planted on deep soil, will resist drought well.
Cupressus elegans.	Elegant cypress.	Tall, straight tree of handsome appearance if given sufficient growing space. Fairly quick-growing. Will resist drought and heat. Frost-hardy. Ornament, shelter and avenues.

Botanical name.	Common name.	Remarks.
Cupressus sempervirens, var. stricta.	Upright common cypress.	Planted for ornament and in cemeteries. Takes up little space. Usually known as the churchyard cypress.
Callistemon lanceolatus.	Scarlet bottlebrush.	Essentially an ornament and low wind-break tree. Thrives best on a light loam or a mixture of loam and sand. Evergreen. Neat appearance. Frost - hardy. Flowers red and shaped like a bottlebrush.
Eucalyptus citriodora.	Lemon-scented gum.	A fair-sized tree with clean stem. Will not withstand much frost or drought, but becomes more resistant as it grows up.
Eucalyptus hemiphloia.	Grey box gum.	Is a good frost and drought-resister. Timber good. Thrives best on river banks.
Eucalyptus melliodora.	Yellow box.	Suitable for dry localities. Drought-resistant and frost-hardy. Does well in sandy loam or slightly heavier soil. Has abundant flowers, suitable for honey production.
Eucalyptus microtheca.	Coolybah.	Stands the extremes of drought and heat; 20 degrees of frost do not affect it. Not tall. Should be planted for shelter. Suited to heavy clay soils.
Eucalyptus rostrata.	Red gum.	Stands drought, heat, brak and flooding. To a certain extent frost-hardy. Not happy on sour soils. Finally tall.
Eucalyptus sideroxylon.	Red ironbark.	Drought-resistant and frost-hardy to a certain extent. Does not like sour soils. Does well on heavy and also on light soils.
Eucalyptus tereticornis.	Red gum tree.	A tall tree. In nature and habits closely related to Eucalyptus rostrata. Requires the same climatic conditions. Not quite so drought - resistant as Eucalyptus rostrata.

Botanical name.	Common name.	Remarks.
Fraxinus americana.	American ash.	Tree with a very heavy crown when planted with sufficient growing space. Makes a handsome ornamental tree. Tall. Thrives on a heavy loam. Excellent shade tree. Not evergreen.
Grevillea robusta.	Silky oak.	A handsome tree. Prefers moist, warm localities. Useful for ornament, shade and timber. Makes a good wind-break. Not frost-hardy.
Jacaranda mimosæfolia.	Jacaranda.	An ornamental tree with spreading crown. Tender to frost. Does well in a sandy loam soil.
Pinus halepensis.	Jerusalem pine.	Drought-resistant and to a certain extent frost-hardy. Resistant to white ants. Does not like sour veld. Will grow on limestone and shale soils. Good shelter tree.
Pinus longifolia.	Chir pine.	Does well in drier districts, but will not stand much frost.
Pinus pinaster.	Cluster pine.	Grows on poor, sandy and sour soils. Does not like a lime soil. Yields good, strong wood. In common with all pines, must be well protected from fire.
Thuya orientalis.	Thuya.	Slow-growing and small tree. Suited to heavy soils, but does better in light soils. Makes a very good hedge. Resistant to heat and drought. Frost-hardy.

FLOWERING SHRUBS.

Botanical name.	Common name.
Abelia floribunda.	
Bauhinia spp.	Bauhinia—mauve and white.
Bauhinia galpini.	Pride de Kaap—red.
Bolusanthus speciosus.	Rhodesia tree wistaria.
Callistemon.	Bottlebrush—scarlet.
Hibiscus.	Hibiscus—red and mauve.
Lagerstrœmia indica.	Pride of India—pink and mauve.
Punica granatum.	Pomegranate—red.
Poinciana pulcherrima.	Bird of Paradise.
Tecoma smithii.	Tecoma—yellow.
Thevetia neriifolia.	Thevetia—yellow.

Farming Calendar.

January.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions against the depredations of white and other ants should also be watched daily. Where possible, examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once, such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing

organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year, are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol used at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanymicus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant, or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses 1½ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Worm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, February and April, 1925.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight.

To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead, 1 lb. in 30 gallons of water.

Wire Worms (*Trachynotus* spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning with a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.).—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutablis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit:—Arsenate of lead (powder), 1½ ozs.; molasses, ½ gallon, or cheapest sugar, 2½ lbs.; water, 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran, and give about one dessert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, *i.e.*, they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Bulls should be returned to the herd during the month if a September or October calving season is desired.

Sheep.—Continue as recommended for December. If heavy rains are experienced a daily ration of a quarter of a pound of maize per ewe will keep them in condition, and will often prevent much trouble arising from poverty and anæmia. Those who favour autumn lambs must put the ram again with the flock in February, and should therefore now take steps (if necessary) by supplying a little extra feed as above recommended to fit the ewes for mating. A little forethought of this kind will tend to increase the stamina of the lambs and to bring the ewes in season more or less together, so that a protracted lambing season is avoided.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

February.

BEE-KEEPING.

In most parts of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due, which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, i.e., to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air- and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock, where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months, frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheesemaking, and great care should also be taken of the starter. If this latter shows any signs of gasiness or develops any disagreeable flavour or odour it should be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first two insects should be heavily pruned or destroyed. The budworm caterpillars can usually be hand picked during the process of topping. (See "Rhodesia Agricultural Journal," December, 1927.)

Potato.—Ladybirds and tuber moth may call for attention. The latter, when very bad, sometimes causes considerable wilting of the crop besides attacking tubers. The ladybirds may be destroyed by spraying with arsenate of lead 1 lb. to 16 gallons of water.

Cabbage Family.—All members of the family are liable to be attacked by the sawfly and webworm. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime (1 lb. Paris green and 20 lbs. slaked lime).

Melon Family.—The most important pest is the melon fly, which "stings" the fruit of all species of gourds. Destroy all badly "stung" fruit and spray remainder thoroughly with arsenate of lead (2 ozs. in 4 gallons of water) to which 2½ lbs. of cheap sugar has been added.

Deciduous Fruit.—Apples, pears and late peaches suffer chiefly from fruit moths, which puncture the fruit. No remedy available except covering the trees with netting.

Fig.—The fruit is liable to the attack of the fig weevil. All infested fruit and all wild fruit should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon bisulphide into the burrow and sealing it up.

Poison Baiting.—Poison baiting against surface beetles, cutworms, etc.: No really effective bait has yet been discovered for cutworms, but the following poisoned bait is recommended for surface beetles, etc.: Paris green 1 lb., 180 lbs. maize meal. Mix thoroughly in dry state and add water until the material is of the consistency of a dough. Roll into small balls and place under shade. Spread in the evening.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gilias, larkspur, dianthus and pentstemon. The flower garden should be now looking its best, nearly all plants being in bloom. Old and dead flowers should be constantly removed, except when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions, carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

FORESTRY.

Tree planting operations should be carried out on dull, showery days or late in the afternoons. Take care in setting out the plants, avoid bending the roots, and do not plant deeper than the plants were in the seed beds or trays. Steps should be taken to prepare seed beds for the slower growing species, i.e., pines, cypresses and callitris, and seed of these species should be sown for the following season's planting.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they must be good, should be kept till about June; there is a demand for such up to this month. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected

for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his best stock, no matter how high a price is offered for it.

By the end of this month the birds selected for breeding should be mated up. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter must be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks must be kept out of the sun and sleep on dry grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk are the chief reasons for non-success in the breeding of turkeys.

STOCK.

Cattle.—Grass should now be at its best, and no anxiety need be felt about feed. In the case of milking cows which have been fed during the earlier rainy months, a little mealie meal, cotton cake or ground nut cake may still be given at milking, if only to bring them quietly to their places. The importance of a clean, light, airy and well-drained shelter for calves cannot be over-estimated. Calves up to three or four months old do not require a great deal of exercise, and on wet days are better left in a dry shed with a little sweet hay. A few hours' exercise on bright days in short grass is all they need. Vigilance in keeping down ticks must not be relaxed. These remarks apply specially to milking herds and to cattle that are kraaled. Cattle running at large need little attention beyond dipping, and if the calves are not desired from November to March, the bulls must now be taken out of the herd. Weather permitting, no opportunity should be lost of getting in a supply of good sweet hay before the grass is too old. A good lick should always be provided.

Sheep.—Vleis and low-lying ground must be avoided. Sheds should be airy, dry and clean. If grass seeds are troublesome to woolled sheep, an area should be mown for them, or when rain begins to slacken, they may be shorn. If wire worm is troublesome, dose regularly each month with wireworm remedy.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping, priming and suckering should be given attention. Selected seed plants should be carefully watched. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

WEATHER.

This is often the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, 7½ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

Southern Rhodesia Veterinary Report.

October, 1930.

ANTHRAX.

Six further cases occurred on the Salisbury commonage, and all the cattle thereon have now been inoculated. An outbreak occurred in a farm in the Mazoe district, and the herd was inoculated. Mortality six.

TRYPANOSOMIASIS.

One case, Melsetter district. Six in Wankie.

QUARTER EVIL.

Only one outbreak reported in Mrewa district.

HEARTWATER.

Two cases reported.

SCAB.

Outbreaks reported on two farms and in a native flock.

IMPORTATIONS.

From the Union of South Africa: Bulls 19, heifers 40, calves 2, horses 5, mule 1, donkeys 64, sheep 2,332, pigs 10. From Bechuanaland: Sheep 438, goats 333.

EXPORTATIONS: CATTLE.

To the Union of South Africa: For local consumption 831, for overseas 1,919. To Belgian Congo: For slaughter 1607, breeding 32. To Northern Rhodesia: For slaughter 122, breeding 11.

EXPORTATIONS IN COLD STORAGE.

Carcases: Beef 769½, calves 39, sheep 70, pigs 30, livers 504, tongues 558, hearts 518, brains 130, tails 593, tripes 495, heads 45, plucks 15, cheeks 25, pork trimmings 220 lbs.

EXPORTATIONS: MISCELLANEOUS.

To Northern Rhodesia: Sheep 326, goats 30, pigs 40.
To Belgian Congo: Horses 3, sheep 45, pigs 198.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

SPINELESS CACTUS.

It is notified for general information that a limited supply of spineless cactus blades are available for distribution this season from the Salisbury Experiment Station. It is not anticipated that more than 10-12 blades can be supplied to each applicant.

Applications should be made to the Chief Agriculturist, Department of Agriculture, Salisbury.

Southern Rhodesia Weather Bureau.

NOVEMBER, 1930.

Pressure.—The mean barometric pressure was generally above normal. Up to the 19th of the month the normal high pressure on the east coast was accentuated and general conditions were stable. Low pressure developed on the 19th, and on the 20th a marked low was off the south-east coast, and the equatorial low was active. The equatorial low swung into Rhodesia on the 21st and withdrew on the 22nd. This movement accompanied the beginning of the rains. Equatorial low activity was again marked on the 26th, when a well developed tongue extended to the south coast. This tongue swung through to the southerly portion of Rhodesia on the 27th, and with slight movements controlled the pressure distribution to the end of the month. The conditions may be classed as unusual, as the greater part of the November rain is usually associated with the influx of highs. During the present month the highs contributed little or no rain, and the types conformed more nearly to mid-season conditions.

Rain Periods.—Isolated showers were recorded on the 2nd and 6th. From the 13th to the 19th scattered showers were recorded daily, on the 20th the number of showers increased, and on the 21st showers were fairly general in the south. On the 22nd showers were fairly general in the north, and extended to cover the whole area on the 23rd. On the 24th and 25th showers were general in the north-east, and they became fairly general again on the 26th. On the 27th showers were fairly general in the south, and extended over the whole country on the 28th. On the 29th scattered showers only were reported, increasing to fairly general in the south on the 30th.

Rain for November.—The total rainfall for November, most of which occurred in the last decade, was 2.81 ins., or about 0.4 in. below the average. The distribution was as follows:—

Zone.	Rain in inches, November, 1930.	Average November.
A	3.11	3.02
B	2.85	2.49
C	2.74	3.40
D	2.36	3.65
E	2.43	3.56
F	2.37	5.01

It will be noted that the amount was extraordinarily uniform over the whole country.

Station.	Altitude	Pressure 8 a.m.	Temperature ° F.						Humidity, 8 a.m.		Precipitation.		
			Absolute.		Mean.			Diff. from Normal.	Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min.						
Bulawayo ...	4,440	868.6	97	59	87.5	61.7	74.6	+2.1	61.5	54	2.62	−0.8	10
Gwelo	4,632	863 1	93	57	85.3	60.6	72.9	+1.5	61.4	56	1.84	−1.8	7
Riverbank ...	(3,700)	...	105	60	92.9	63.2	78.0	+1.4	63 7	52	4.15	+2.0	12
Brunapeg ...	(3,000)	...	...	...	...	...	...	...	...	...	...	...	...
Essexvale ...	3,828	...	103	59	92.1	63.8	77.9	+2.6	...	...	7.72	+5.5	7
Gwanda ...	3,235	906.7	103	58	91.2	64.6	77.9	...	63.7	53	3.22	+1.1	4
Holly's Hope ...	3,420	...	100	59	91.9	64.2	78.0	+1.6	64.4	42	3.82	+1.5	5
Nuanetsi ...	1,630	...	106	57	98.7	66.7	82.7	...	67.4	50	1.95	−1.0	4
Between Rivers	3,970	...	...	...	...	...	...	...	...	...	...	...	...
Enkeldoorn ...	4,720	...	93	54	83.8	59.6	71.7	+1.0	61.7	50	2.02	−1.4	7
Gatooma ...	3,850	...	99	58	89.1	63.3	76.2	−0.3	64.4	57	2.15	−0.8	11
Miami	4,090	...	...	...	...	...	...	...	...	...	...	...	...
Salisbury ...	4,865	856 2	91	57	82.4	61.3	71.8	+1.2	64.0	54	2.23	−1.1	...
Sinoia	3,830	...	97	55	89.1	63.5	76.3	+0.2	64.5	51	2.35	−0.9	9
Sipolilo... ...	3,900	...	95	51	84.8	62.2	73.5	...	64.0	55	2.54	−0.7	9
Juliasdale ...	6,070	...	86	48	76.0	54.3	65.1	+1.3	59.1	63	2.13	−1.5	9
Mtoko	4,210	...	...	...	...	...	...	...	...	...	...	...	...
Shamva ...	3,170	...	...	...	...	...	...	...	...	...	...	...	...
Virginia Estate	3,730	...	100	56	89.5	61.8	75.6	...	64.7	61	3.36	−0.2	7
Angus Ranch ...	(2,300)	...	104	66	93.7	70.9	82.3	...	68.7	55	1.10	−0.9	6
Craigendoran ...	(3,000)	...	...	...	...	...	...	...	...	...	...	...	...
Mount Arthur...	(5,000)	...	...	...	...	...	...	...	...	...	...	...	...
New Year's Gift	2,700	...	97	60	88.7	63.1	75.9	...	63.5	49	2.65	−0.4	5
Nyamasanga ...	5,080	...	91	50	82.3	56.5	69.4	...	61.4	57	6.04	...	9
Riverdene North	3,700	...	99	54	89.3	61.8	75.5	+0.7	65.4	62	3.02	+0.2	8
Stapleford ...	5,450	...	84	50	75.2	55 2	65.2	..	59.4	72	5.85	−0.1	12
Umtali	3,677	894.0	93	57	83.9	62.4	73.1	+1.1	63.8	63	3.26	−0.4	9
Victoria ...	3,570	899.4	96	54	87.4	63.1	75.2	+2.9	64.4	51	2.47	−0.5	6
Melsetter ...	5,060	...	87	51	80.2	58.6	69.4	+1.9	61.0	53	2.46	−2.5	6
Mount Selinda...	3,520	...	91	55	81.9	60.2	71.0	+1.3	64.1	70	3.32	−1 5	8

Export of Cattle from Southern Rhodesia, 1930.

Month	Union — Slaughter — Union of S.A.	Union — Slaughter — I.C.S. for overseas	England — Slaughter — On hoof	Congo — Slaughter	Congo — Breeding	N. Rhodesia — Slaughter	N. Rhodesia — Breeding	Portuguese East Africa — Slaughter	Portuguese East Africa — Breeding	Total
January ...	...	...	...	2,449	67	...	...	...	...	2,516
February ...	...	...	..	3,438	8	537	91	...	11	4,085
March ...	25	...	160	1,097	...	249	...	...	7	1,538
April ...	53	863	...	2,636	115	120	16	...	...	3,803
May ...	783	1,628	160	1,517	593	268	176	...	...	5,125
June ...	1,132	2,660	...	1,810	11	407	...	...	...	6,020
July ...	1,273	5,505	...	1,525	2,257	299	128*	...	...	10,987
August ...	1,661	5,939	...	2,673	...	332	...	...	7	10,612
September ...	1,031	2,871	...	2,440	60	460	30	...	...	6,892
October ...	831	1,919	...	1,607	32	122	11	...	...	4,522
November ...	592	390	...	1,168	...	475	...	...	...	2,625
December ...										
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* Trek oxen.

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Farming Returns for Income Tax Purposes.

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Seeds for Sale, Gwebi Farm.

		s.	d.
Majorda Seed	at per lb.	1	1
Sunflower Seed (Large Black)	at per 100 lbs.	16	0
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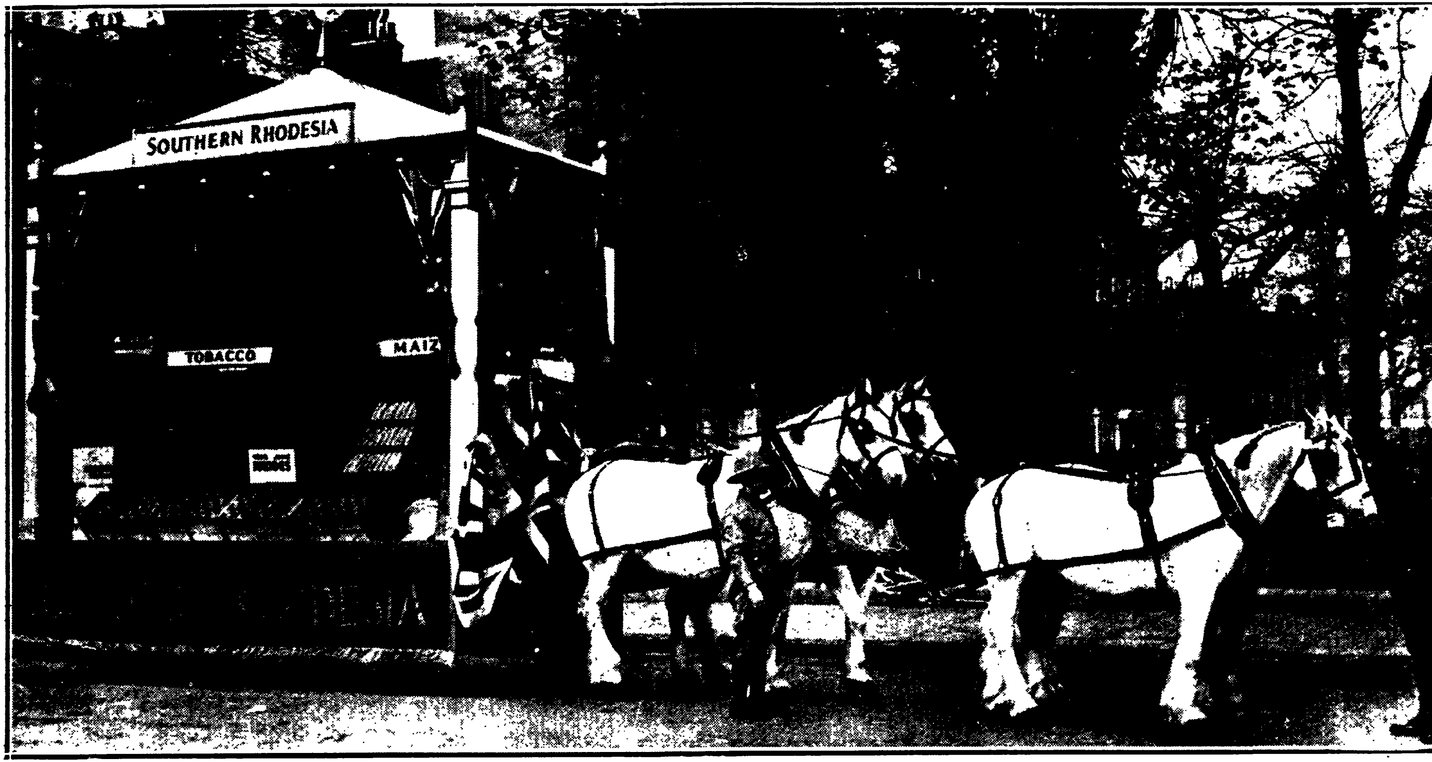
Dolichos Beans	at per 100 lbs.	21	0

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*



The Rhodesian exhibit at the Lord Mayor of London's Show, November, 1930.

THE RHODESIA

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Acting Editor - - *J. A. T. Walters, B.A.*

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

The Southern Rhodesian Display at the Lord Mayor's Show.—Last November the striking display shown on the opposite page was staged at the Lord Mayor's Show in London, and attracted considerable attention and favourable mention in the Press. The present is the day of publicity. Lands and products that were unknown a few years ago are now by dint of advertisement familiar to the man in the street. Travel has been made easier, safer and cheaper in every way, and people are evincing an ever-increasing desire to be better acquainted with distant people and their activities. Africa has long lost its "savage" attributes, and the perpetual mystery that hangs over it constitutes a powerful attraction, which is stimulating a very lucrative tourist traffic. And the more the attractions and possibilities of Rhodesia are generally realised, the more freely will population and capital move in from the more congested portions of the world.

Sheep Possibilities of Southern Rhodesia.—In the present issue we publish Mr. Warren's report on the suitability of Southern Rhodesia for the production of sheep and wool; and what is said by so eminent an authority will be read with interest by all who are in any way connected with farming. Mr. Kruger's report on sheep farming in Melsetter appeared in the January issue, and together these reports place the position clearly before the farming community, which will now appraise it correctly. The vague fears which have hitherto been associated with sheep rearing will be largely dissipated when it is realised what the lack of success in the past has been due to. The parasitic pests to which sheep appear particularly susceptible are shown to be controllable by appropriate dosing and rotational grazing, and the lack of nitrogenous phosphatic materials in the feeding naturally provided by the veld in winter can be overcome by the preparation of suitable feeds easily grown in Rhodesia. It does not, of course, follow that the methods which have been so eminently successful in the Union may be completely suitable for this country, but we cannot expect to succeed unless we are prepared to take at least an equal amount of trouble on our part. The path has, however, at last been made clear for experimentation, and the light thus shed on the problem will undoubtedly stimulate interest in an industry which may yet add vastly to the wealth of the country.

Grass Pastures.—The subject of grass treatment is at present receiving a measure of attention more in proportion to its tremendous importance in the practice of agriculture; and this attention, which is taking the form of research, seems to be almost universal, being especially marked in those countries where pastures are considered to be exceptionally good, such as England and Germany. The need for such work is much more emphatic in a country like Rhodesia, where grazing, although abundant at most times, cannot be said to be good, except during short periods of favourable weather conditions. But if improvement is considered essential in such countries as England, how much more is it necessary in Rhodesia, where we are hoping to raise cattle

profitably for the English market. Certain essential facts about grazing have already been acquired empirically, such as the improvement that follows intensive cultivation for a limited time, and the value of paddocking and fertilising. But the science of grass management in semi-tropical areas may be said to be in its infancy, and our readers will welcome the contribution in this issue by the Chief Chemist and his assistants, who are devoting special attention to this subject during the next few years. The effect of a wider and more accurate understanding of the subject upon the cattle industry may well be incalculable, and the progress of research during the next few years will be watched with keen interest.

Costs of Production.—It appears to be a strange anomaly that at a time when the primary production of essential foodstuffs such as maize, wheat and barley has reached unparalleled dimensions the world should be passing through a period of unusual financial depression. These after all constitute the true wealth of mankind, and in ancient days riches were actually measured in terms of grain and beasts. Why then the financial stringency, particularly among farmers? Is it possible that this abundance is being obtained at costs beyond the value of the article produced? Have we mastered the business of the economic handling of motive power, which is as yet a comparatively new factor in farming practice? And are there secrets in the maintenance of high productivity that have yet escaped us? The subject of cost of production is more and more demanding the attention it deserves, and in measure as this is lowered without a sacrifice of efficiency the more will the farmer benefit when circumstances affecting supply and demand will again cause the price of his commodities to rise.

Prizes and Cups for Milk-recorded Herds.—In order to encourage the progress of the milk-recording scheme in this Colony, valuable cups and prizes have been promised by various gentlemen and business firms. Thus Mr. Kilburn, senior, of Dorset, England, has promised a cup to be

awarded to the best milking herd in Mashonaland, whilst Mr. R. le S. Fischer, of Headlands, has promised a cup to be awarded for the best average production of butter fat in Mashonaland. The Farmers' Co-op., Salisbury, have promised a ton of ground nut cake and the Central Cotton Ginneries, Salisbury, have donated a ton of cotton seed cake, whilst the Express Nut Oil and Soap Works Company, Salisbury, have promised a half ton of ground nut oil cake.

Full particulars as to the conditions on which these cups and prizes will be awarded will be announced later, but it may be mentioned that cows at present being recorded are eligible to enter for the competitions. It may, however, be stated that only cows belonging to owners who are making butter or supplying cream to creameries or milk to cheese factories are eligible to compete. Town dairymen who supply milk to towns and who, of course, enjoy peculiar advantages are excluded from participation in the prizes.

Rhodesian Tobacco Supplies in England.—Stocks on hand of Rhodesian tobacco in London on the 30th September, 1930, amounted to approximately 13½ million lbs. Withdrawals from bond over the period 1st January to 30th September, 1930, amounted to approximately 5,350,000 lbs., compared with 3,600,000 lbs. for the similar period of 1929 and 5,200,000 lbs. for the full year of 1929. Based on deliveries during the year 1929, the stock on hand at the 30th September, 1930, was sufficient for two and seven-twelfth years' supply.

Imports of Southern Rhodesian tobacco to the 31st October were roughly 2½ million lbs., compared with 3¾ million lbs. for the corresponding period of 1929. It is probable that imports for the full year 1930 will aggregate 3½ to 4 million lbs. Normally stocks of American tobacco in bond comprise one and eleven-twelfth years' supply. This figure is gradually being approached by Rhodesian tobacco, so that the outlook as far as the United Kingdom market is concerned is steadily becoming more hopeful.

The following interesting notes on mole drains and the control of stalk borer have been supplied by Mr. E. E. Wright, manager of the Government Farm, Gwebi, as a result of his experience:—

Mole Drains.—During the season 1929-30 six mole drains 100 yards long and 33 yards apart were put down in a black clay vlei in the south end of Plot No. 21. During the subsequent rains these drains were found to act extraordinarily well, but it was apparent that they were too far apart and would have been better somewhat closer, so as to get the full benefit from them.

This season (1930-31) approximately 10 acres of land which two years ago had to be discarded on account of becoming water-logged were drained. Mole drains 200 yards long were put in at 10-yard intervals. Before putting in the drains the land had been ploughed. This was found to be a disadvantage, for when we tried to do the draining by means of a tractor this could not get a grip in the loose soil. We had therefore to resort to ox power, but even with 24 oxen it was only possible to put the drains 14 inches below the surface, because of the heavy draught. Up to the present, as far as one can judge, the drains are working well and are keeping the land drained. It is to be noticed also that the six drains put in the previous year are running freely. Land slightly higher-lying than that drained is still too wet to work, whereas the drained land can be cultivated with ease. Eighteen inches to two feet would, I think, be a better depth to aim at if possible, so that future ploughings are not so likely to disturb the drains.

To date I have drawn the following conclusions:—

1. The drains should be put down before the land is ploughed and as soon as the crop is off.

2. If new land, the grass should be cut and the drains put in as soon as the land is dry enough to take the weight of a tractor or oxen.

3. The drains should not be further apart than 10 yards.

4. The drains should be at least 14 inches deep, and for preference as deep as 2 feet.

5. The main furrow into which the drains run should be at least 18 inches deeper than the exit holes of the drains, so as to avoid the drains becoming silted up after storms.

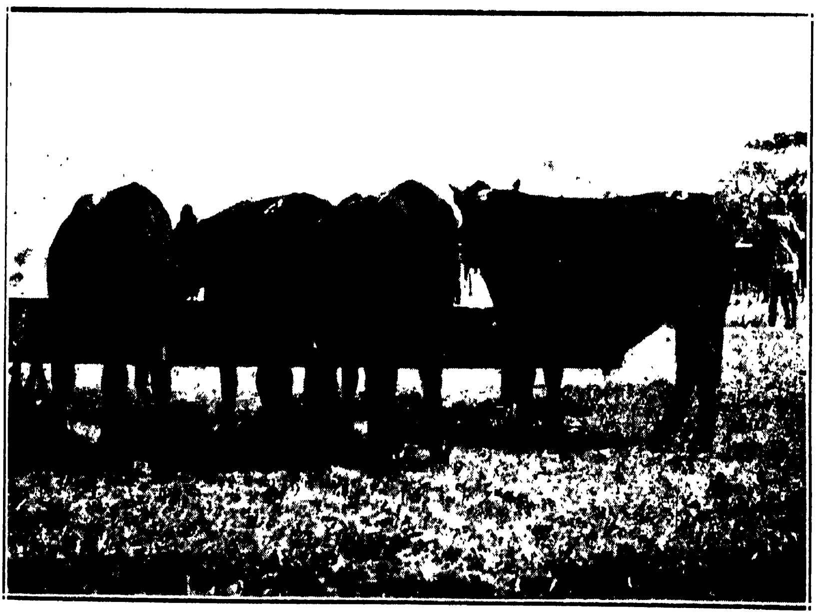
6. Land in which there are large ant-heaps can be drained by taking the drains round the ant-heaps on the contour.

Control of Maize Stalk Borer.—To control maize stalk borer it has been the practice at Gwebi during the past four years to "top" the maize plants by breaking them off just below that portion visibly affected by the grub. This was done as soon as the plants showed the first signs of infection.

This season, 1930-31, dressing the plants with Derrisol diluted 1 in 1,000 parts of water is being tried out. So far as can be judged up to the present, this treatment is quite successful. Care must be taken to see that the boys apply the liquid well into the centre of the top of the maize plant, i.e., into the little cup formed by the leaves. The boys are provided with knapsacks holding two gallons of the liquid each, which are slung on their backs. A short length of rubber tubing is fixed on to the tank or knapsack, and on the tube is a small clip, which on being pressed allows a certain amount of the liquid to run out.

Three knapsacks were purchased from the Union, but now seven other similar contrivances made out of petrol tins on the farm are proving quite as satisfactory as the bought article.

Only maize infested with borer is being treated, and one boy is doing about ten acres a day.



Excellent types of bullocks for export.
Bred by C. C. Macarthur, Salisbury, and
J. R. Stewart, Shangani.
The value of the bullocks in the upper picture would have been improved had they been de-horned.

The Export of Bullocks to England.

By Dr. A. E. Romyn, Senior Animal Husbandry Officer.

Arrangements are now complete to send two shipments of bullocks to England in March and April next. A great deal of interest has been shown in these shipments, and a few preliminary notes on their organisation should be of value here. Later in the year it is hoped to publish a detailed report of the various contributions of cattle, giving a more complete account of the methods followed and the results achieved.

The work of organisation has been carried out by the Department of Agriculture, with the co-operation of two cattle committees—one in Matabeleland, with Mr. J. R. Stewart as chairman, and one in Mashonaland, with Mr. A. Maclean as chairman.

It is planned to forward 400 head of cattle by the s.s. Clan Morrison, loading in Capetown on 21st March, and 500 head on the s.s. Heraclides, sailing during the third week in April.

The period during which best prices are usually obtained for cattle from overseas on the Home market is from February to May inclusive, and the dates of the shipments have been so arranged as to land the cattle during those months. As the trade develops, however, and becomes more organised, it is hoped that it will be profitable to ship cattle at other times of the year as well.

With the exception of 60 head from Bechuanaland in the second consignment, all these cattle come from Southern Rhodesia. At one time it was expected that a number of cattle would be sent from the Union of South Africa, but the increase of ocean freight to £9 from £7 10s., and the dry season in the south, have caused Union shippers to drop out.

All bullocks have to be inspected and passed prior to shipment. As far as possible the bullocks are inspected before they are put on feed so as to prevent the fattening of animals undesirable for export. It is hoped in this way to maintain a high standard of quality in these shipments and so create a reputation for Rhodesian bullocks on the English market.

Old oxen or coarse heavy bullocks are not accepted for shipment. The type of bullock most desired at present is one of good beef type, three to four years of age, de-horned and weighing not less than 1,200 lbs. live weight when shipped. The present tendency, however, is to ship heavier bullocks so as to reduce the overhead charges and transport costs per beast, and shippers are generally advised not to send light bullocks.

Cattle for these shipments should make most of their gains on grass, but it will usually be necessary to give them some supplementary feeding in order to secure the desired finish and to accustom them to hand feeding for the voyage. The amount of supplementary feeding will depend on the nature of the veld and the condition of the bullocks when put on feed.

Generally speaking, the bullocks should be run in moderate-sized camps with good water and shade. They should get the best grazing available. Frequent handling is an advantage, as it makes them quieter and easier to ship. During the months of November and December the cattle should fatten satisfactorily on grass alone. From January on, however, it will be necessary to feed the bullocks at night, or night and morning, with a feed of "hard grain."

The most suitable grain ration will vary with the nature of the veld and the month of the year. As grass matures, its feeding value and content of digestible protein decrease, and the grain ration should be increased and altered accordingly.

The following feeding schedule can be used as a basis and modified to suit individual conditions:—

January.—A grain ration of maize alone, or maize 300 lbs., sunflower meal 100 lbs.; 4 lbs. per head per day.

February.—A grain ration of maize 600 lbs., ground-nut cake 100 lbs.; or maize 500 lbs., sunflower meal 100 lbs., ground-nut cake 100 lbs.; 6 lbs. per head per day.

March and April.—A grain ration of maize 400 lbs., ground-nut cake 100 lbs.; or maize 300 lbs., sunflower meal 100 lbs., ground-nut cake 100 lbs.; 8 lbs. per head per day.

The maize, sunflower head and seed may be ground up together. Kaffir beans, cotton cake and ground nuts can replace the ground-nut cake, which supplies the essential "protein," but should be used in larger proportions. Feeders desiring more information on this point should write to the Department of Agriculture. The addition of 2 per cent. of sterilised bone meal and 1 per cent. of salt by weight to the grain ration is recommended. The quantities of grain given are for store bullocks in good average condition at the start of the feeding period and grazing on average veld. Where the veld is better or worse the quantity of grain should be modified accordingly. On really poor veld the quantity of grain required to produce a desirable finish may be too great to make fattening profitable. Land of this nature should be used for growing cattle rather than fattening.

A great deal of the success or failure of the enterprise depends on the price paid for the store bullocks. The cheaper the cattle are bought, the greater is the likelihood of profit. So many circumstances have to be taken into consideration that it is not possible to set a definite upper limit of price for store bullocks. Under present marketing conditions, however, 12s. 6d. per 100 lbs. estimated live weight appears to be as much as the average feeder is usually justified in paying for suitable stores.

Where circumstances permit, one of the best systems of purchase is to buy suitable young store bullocks at the end of the grazing season previous to export. Bullocks can usually be bought relatively cheaply at this time—say, in April—and carried through the winter with some roughage feed to supplement the grazing. This plan will allow them time to acclimatise, quieten down, learn to feed and put them in shape to take immediate advantage of the grass the following season.

At present there is a shortage of suitable store bullocks, and an increase in the demand for export stores may for some time force the price up to unprofitable levels for the feeder. For this reason breeders who can breed their own stores are well advised to do so.

The Government has given the necessary freight guarantees to the shipping companies for these shipments and is advancing the money to meet the cost of export—approximately £14 per head. The scheme in its present form will be a serious test of the dependability of the feeders who have undertaken to produce the cattle and of the reaction of the English market to fairly large consignments of Rhodesian cattle. Its success will mean an important step forward in the establishment of an export trade in beef.

Notice.

ADVICE ON SOIL EROSION—MARCH, 1931.

Provided there is a sufficient response, the Irrigation Division proposes to carry out tours of advice on soil erosion in March or early April. This is of particular application to farmers who wish to construct contour ridges on lands where green manure crops have been ploughed in. Where this can be done a considerable saving in the cost of the work can be effected, since the soil is usually easier to handle than in the dry season. Storm-water drains also can be more cheaply dug.

Applications for such visits should be made as soon as possible, preferably by secretaries of farmers' associations, giving a list of the names and addresses of members wishing advice, together with the approximate date on which the tour is desired, and the estimated time which each visit will take.

Applications should be addressed to:—

The Chief Irrigation Engineer,
P.O. Box 387,
Salisbury.

The Sheep Industry of Southern Rhodesia.

By E. N. S. Warren,
Acting Principal Sheep and Wool Officer, Union of South Africa.

In submitting my report on the above subject, I propose to cover the following ground:—

A. The present position of the sheep industry.

B. The future of sheep farming in Southern Rhodesia (with reservations).

C. Recommendations and conclusions.

D. Specific recommendations.

In company of Dr. A. E. Romyn, Senior Animal Husbandry Officer, and Mr. D. A. Lawrence, of the Veterinary Research Department, Salisbury, we travelled by car, covering approximately 2,000 miles. The number of farms visited in different areas is given below:—

Area	Farms Visited
Marandellas	5
Inyanga	2
Enkeldoorn	5
Melsetter	16
Fort Victoria	3
Gwelo	5
Shangani	2
Plumtree	3
Bulawayo	5
Total flocks seen	47

The attached map indicates the routes followed and the areas visited.

A. **The Present Position of the Sheep Industry.**—Southern Rhodesia in its present untamed state and general lack of the first principles of sheep management among its farming community is in general unsuited to sheep farming with its present breeds, viz.:—

1. Kaffir sheep.
2. Blackhead Persian.
3. Merinos.
4. Woolled Persian grades.
5. Crosses between the above breeds.

Sheep farming is in an elementary stage of development. The chief obstacles to its progress are (a) diseases and pests, (b) the unimproved condition of large tracts of grazing lands, (c) with few exceptions, the farmers' lack of sheep knowledge, (d) in certain parts grass seeds which penetrate through the skin of woolled sheep.

The lack of knowledge with respect to intestinal parasites and control has resulted in enormous losses.

The absence of good fencing necessitates the most primitive type of flock management, the drawback in this connection being the high cost of fencing material.

In general under-stocking is in evidence. The advantages of keeping grazing short by heavy stocking are admitted. While some farmers are anxious to increase the size of their flocks, they are reluctant to resort to importations, as these are likely to be less resistant to disease than the locally bred stock.

A further factor that is retarding the industry is the lack of working capital. Too much capital is locked up in land, in the hope of a land boom, instead of being used in developing small farms.

Sheep farming should be looked upon as a means to provide a livelihood and not as the road to rapid affluence.

Post mortems were held on 12 farms by Mr. D. A. Lawrence.

The following reflects the extent of parasitic infection:—

Nodular worm was found on 12 farms, i.e., all.
Liver tape worm was found on 9 farms.
Bankrot worm was found on 7 farms.

Hook worm was found on 7 farms.
Wire worm was found on 5 farms.
Stomach flukes were found on 3 farms.
Intestinal tape worms were found on 2 farms.
Schistosomes were found on 1 farm.

The above indicates the prevalence of nodular worm and liver tape worm, as also the intense infestation of all types of internal parasites.

In addition three flocks were found to be infected with scab. In one instance the infection was about twelve months old, and no attempt was being made to eradicate the disease. The owner was a ram breeder and had sold several animals from the infected flock to various purchasers during the year.

No cases of wire worm infestation were found where regular dosing had been carried out with Government wire worm remedy. No hook worm was found where carbon tetrachloride had been recently used. The eradication of these two very harmful parasites presents no difficulties. There remain, however, two other worms, viz., bankrot and nodular, that cannot with our present knowledge be so easily controlled, and the success or the failure of the sheep industry of Southern Rhodesia is in part dependent on adopting methods of controlling these. This can only be done by adopting a system of veld rotation and so starving out the parasite. Pasture rotation, however, must be practised in conjunction with regular dosing, and provision must be made to supplement the natural grazing during the dry season in order to give the animal the extra stamina to enable it to resist the infection. The natural pastures of Southern Rhodesia are very deficient in protein and phosphoric acid during the dry season.

There are two sayings in Southern Rhodesia: (1) "That with sheep you will always end where you started"; (2) "That sheep do quite well, provided one only keeps to small numbers." Both of these sayings were found to be in the main perfectly true. It was not at first apparent why this should be, but it was soon appreciated that with the most gross mismanagement small flocks of under 100 were doing remarkably well in practically every case, whereas the most cared for flocks of over 1,000 were in a large measure meeting with failure. Rhodesian farms are large, and the native

youth entrusted with the care of the flock during the day has his limitations.

Peculiarly enough the small flocks of those owners who take least interest seem to thrive best. This is because the native herd boy, left to his own devices, practises with his small flock an almost perfect system of veld rotation, in that his small flock does not graze on the same veld month by month; he has his traps, nooses and bird nesting to see to, and after a time he tries new hunting grounds. Under these conditions the small flock increases rapidly in numbers, and before long the owner is obliged to divide the flock into smaller flocks. Each of these is confined to a limited area. Rotation ceases, and the farm becomes heavily infested with parasites. Control measures are not in operation, with the result that within a very short period the numbers are reduced to starting point.

Kraaling Arrangements.—(a) In only two instances were farmers found to follow a system of allowing their sheep free range, and in both these instances the benefits were remarkable. Other methods adopted consisted of:—

(b) Fairly large vermin-proof sleeping paddocks, where the sheep could find a certain amount of grazing. Such paddocks soon become heavily infested with parasites, and of all methods practised, this is the worst.

(c) Small well sheltered vermin-proof paddocks that afford no grazing; this was found to give very good results from the internal parasitic point of view.

(d) Sheds. These, to be successful, must be large and well ventilated, otherwise there is a tendency for the sheep to sweat and become overheated during the rainy season. If they become wet under foot, they are worse than useless; in fact, they are a source of danger.

(e) Small well sheltered vermin-proof paddocks containing roofed shelters, sheep only to be driven under shelter during rainy nights, were found to answer very well.

B. The Future of Sheep Farming in Southern Rhodesia. —*Mutton Sheep.*—With a very limited consuming population and no present prospect of export, there is no immediate future for the purely mutton breeds such as the native and the Blackhead Persian. This, however, affords no reason

why the Government should not do all within its power to improve the conditions of those at present owning these breeds, but in no way should other farmers be encouraged to become breeders of these types.

Woolled Sheep.—The Merino, though more resistant to internal parasites than the Blackhead Persian, is at a great disadvantage in country containing spear grass (*Heteropogon contortus*). The presence of this and other injurious grass seeds eliminates the Merino unless the farms are paddocked and the grass controlled.

C. **Conclusions and Recommendations.**—Portions of Southern Rhodesia are likely to become contributors to the progress of the sheep industry of Southern Africa. However, the share of such advancement can be assured only upon the elimination of certain inhibiting factors which make for retardation.

Adverse conditions play a relatively important part in restricting the extent of the developing of sheep farming. Any permanent development of this industry is dependent on certain fundamental changes affecting the farmer, the existing systems of farming, and even State administration concerning matters which are considered to be beyond the scope of the individual farmer.

The presence of successful sheep farmers on representative holdings indicates the adaptability of certain areas to the sheep farming enterprise. However, it is evident that farmers of Southern Rhodesia have but a meagre knowledge of sheep and wool, and also that they have not yet made a comprehensive study of the care and management of their flocks under their specific or peculiar conditions. Undoubtedly these shortcomings can be attributed to the fact that the majority of the farmers have steadfastly adhered to antiquated ideas with which they have lived in isolation for many years.

Evidence clearly indicates that many of the problems are such that only united effort will yield good results of a general application and of a permanent nature. Through better organisation and co-operation, solutions to the following problems are more likely to become effective within the near future:—Fencing improvement, the destruction of vermin,

the establishment of marketing facilities for all farm products, the proper execution of disease control measures, and the simultaneous development of complementary farm enterprises.

It is hoped that in the near future farmers will be given the opportunity of deriving greater benefit from the advice and organising powers of officers of the Department of Agriculture.

The importance of evolving efficient practical methods of veld improvement and veld management warrants special mention. Admirable instances of improved veld were seen.

The possibility of supplementing natural pastures with artificial temporary pastures and sheep feeds grown on the farm requires careful consideration. In the growing of crops, legumes should be given special consideration.

Melsetter is perhaps the best district from a point of view of sheep and wool and crop production, although in most areas the conservation of water will permit of the growing of valuable hay crops.

The Experiment Station at Matopos is admirably situated for testing the suitability of sheep for a large section of the country.

The types of live stock, or the numbers of each type of live stock, maintained on farms in the various districts must of necessity suit the existing circumstances.

Cattle are indispensable where the grass grows too long and too coarse for sheep. That sheep can be maintained throughout the year where the vleis remain wet during the dry season is inconceivable.

The Blackhead Persian is found to yield profitable returns under certain conditions. This type of sheep is recommended in the lower rainfall areas and where grass seed is a serious menace to the Merino.

When considering the importation of Merino sheep, farmers show a preference to grass veld over Karroo sheep.

Ruinous diseases and pests are the most important factors inhibiting the progress of sheep farming. Nodular and bankrot worms are the despair of the stock farmer in the majority of districts surveyed. Blue tongue occurs in varying degrees of severity.

Successful methods of combating and preventing the occurrence of the most destructive and more frequently occurring diseases should be broadcasted by the Government Veterinary Department. Although the most progressive farmers attribute much of their success to the thorough adoption of the preventive measures advocated by the Veterinary Department, it is lamentable to find that these measures of disease control are not given a thorough application by the bulk of the farmers.

In the above connection, measures advocated by the Veterinary Research Department are recommended. See Bulletin No. 60 of 1929, by D. A. Lawrence, B.V.Sc.

The main problems of the country are:—

1. Internal, and to some extent external, parasitic infestations.

2. Deficiency during dry winter months of the phosphoric acid and protein content of the natural pastures.

3. Grass seeds in certain portions of the country.

4. Excessive rain from December to March.

5. Carnivora.

6. High cost of fencing material.

7. Lack of markets.

In no area is sheep farming likely to be a major project to cattle, except perhaps in certain parts of Melsetter, comprising about 50 farms. This district is very different to the rest of the country and might well be considered as a separate state. Excessive heavy rainfall is the greatest obstacle. Nevertheless this district should be chosen as the one with the greatest possibilities of success for woolled sheep.

If sheep were farmed in the Union under the same primitive conditions as in Rhodesia, it could only be made a success in the most select localities.

It is therefore suggested that the Merino be given the same facilities for proving its worth as are given to it by an up-to-date sheep farmer in the Union.

Recent Developments in Weather Forecasting.

By N. P. Sellick, M.C., B.Sc., Assistant Hydrographic Engineer.

Systematic forecasting of the weather has been carried on for a period of 70 years. It had long been known that the changes of weather were associated with changes of the height of the barometer. When the first weather maps (maps showing the weather at a certain hour over a large area) were plotted, it was natural for the investigators to turn to the air pressure as a solution of their problem. It was soon discovered that the pressure map or isobar chart was divided into areas of high and low pressure which moved from day to day in an easterly direction, and that the weather experienced with a certain type of pressure distribution was always more or less the same. An area of low pressure consists of closed isobars surrounding a centre of lowest pressure; the winds blow along the lines of equal pressure in a counter-clockwise direction, and their strength is proportional to the steepness of the pressure gradient. The south-east quadrant of a cyclone is associated with overcast skies and steady rain, the south-west with sharp squalls and thunderstorms.

An elaborate system of forecasts was based on rules culled from experience, and the system is still holding its own in some meteorological services.

Various theories have been put forward from time to time to explain the different features of the weather map, but the majority have had little success.

About ten years ago the Norwegian meteorologists put forward the "polar front" theory. This theory is, in essentials, that the cold air of the polar regions and the warm

air of the tropical regions are divided from one another by a "front." The necessity for an exchange of air between the equator and the poles is a commonplace of all meteorological theory. The innovation was the introduction of the front or battle zone. This front encircles the globe on both sides of the equator and is more or less continuous. The battle is going on all the time, and the front sways backwards and forwards over the temperate zones as first one and then the other combatant has the advantage. A tongue of warm air invades the cold zone, and the cold air rushes round behind it; eventually the warm air is cut off from its main body and, on account of its comparative lightness, is lifted off the surface and removed from the battle front. Each of these "little battles" is a cyclone. The area where the warm air is attacking and rising over the cold is an area of overcast skies and rain, and is called the warm front. Behind this is an area of warm air in steady motion going to the attack. Further behind we find the cold air attacking from the rear. This attack is violent and is marked by a sudden fall of temperature and heavy squalls of wind. Finally the whole of the warm air is driven up between the retreating cold air in front and the attacking cold air behind, and the latter, having lost its prey, proceeds to attack its fleeing comrade. The fight is over, however, and unless the remnant of warm air which has escaped capture is in a position to renew the onslaught, the front straightens out for the moment and the lucky area over which this happens enjoys a fleeting spell of fine weather.

This scene of perpetual warfare is laid in the temperate zones, and we in Southern Rhodesia rarely if ever experience a cyclone. The cyclones and hurricanes of the tropics have not been thoroughly investigated, but appear to be very different. Southern Rhodesia lies in the reserve positions of the tropical forces, the battle zone being in the "roaring forties" far to the south. No place on earth is entirely safe from disturbance, however, and from time to time a triumphant detachment of cold air breaks through and rushes up the east coast, invading Southern Rhodesia via the Limpopo Valley. This polar air is usually more or less heated by its earlier encounters—sometimes, as on the 15th September last, rather less than more.

The polar front theory, it can be seen, only serves to explain one small phase of our weather.

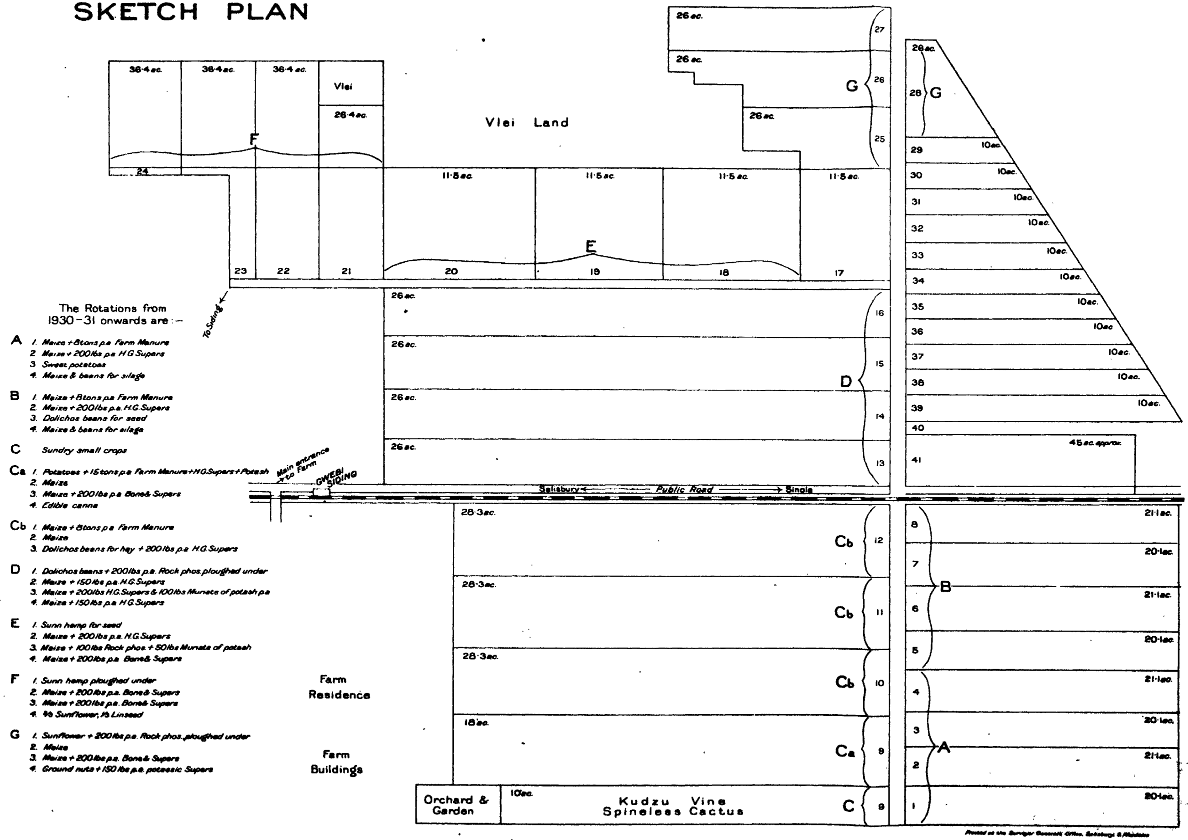
We are indebted to Bergen for a great deal more than this. The Norwegians have also investigated the occurrence of "local summer showers," and have found that these are associated with the slow movement of sea air of high absolute humidity during periods of quiet on the polar front. This is roughly what happens in Rhodesia, only on a far larger scale. As a reserve position for the tropical forces, we are, in the rainy season, constantly receiving reinforcements.

The back areas have not as yet been properly explored, but it appears that some of these reinforcements are drawn from the northern part of the Indian Ocean and come to us over many miles of warm sea. The air is, in consequence, very humid, and its appearance on our borders is at once evident on a map showing absolute humidity. This air, owing to its humidity and probably to other causes at present unknown, is the source of the greater part of our rain, and the rain is convection rain and therefore independent of other disturbances. In this air local convection may take place wherever circumstances are favourable; the probability that rain will fall somewhere in the area is very high; the probability that it will fall everywhere in the area is very small. There have been cases where the official reporting stations in certain parts have reported practically no rain, whereas an examination of the full records has proved that the rain was fairly general.

The use of absolute humidity in local forecasting has proved itself in the last two years, and a map showing the humidity at a large number of stations in Southern Rhodesia and near the borders is plotted regularly. From this map it is often possible to define the areas where rain will fall, but owing to the movement of the air with changing winds, it is not possible at present to anticipate the future conditions. Further investigations are being made. It is known that the convergence and divergence of stream lines of air are closely related to rain, and that very faint local disturbances of pressure cause storms. The existing organisation is insufficient to deal with these factors satisfactorily, but it is hoped that the problems will be solved as development goes on.

Farmers' Day gathering: Explaining the cropping systems followed.

SKETCH PLAN



Vlei Land
Vlei
36·4 ac.
36·4 ac.
36·4 ac.
26·4 ac.
F
24
23
22
21
11·5 ac.
11·5 ac.
11·5 ac.
11·5 ac.
E
20
19
18
17
26 ac.
26 ac.
26 ac.
27
26
25
G
26 ac.
26 ac.
26 ac.
26 ac.
16
15
14
13
D
28 ac.
28
G
29
30
31
32
33
34
35
36
37
38
39
40
41
10 ac.
45 ac. approx.
To Siding
Main entrance to Farm
GWEBI SIDING
Salisbury ← Public Road → Sinoia
28·3 ac.
28·3 ac.
28·3 ac.
18 ac.
10 ac.
Cb
Cb
Cb
Ca
C
12
11
10
9
9
Orchard & Garden
Kudzu Vine
Spineless Cactus
Farm Residence
Farm Buildings
8
7
6
5
4
3
2
1
B
A
21·1 ac.
20·1 ac.
21·1 ac.
20·1 ac.
21·1 ac.
20·1 ac.
21·1 ac.
20·1 ac.
The Rotations from 1930-31 onwards are :-
A 1. Maize + 8 tons p.a. Farm Manure
2. Maize + 200 lbs p.a. H.G. Supers
3. Sweet potatoes
4. Maize & beans for silage
B 1. Maize + 8 tons p.a. Farm Manure
2. Maize + 200 lbs p.a. H.G. Supers
3. Dolichos beans for seed
4. Maize & beans for silage
C Sundry small crops
Ca 1. Potatoes + 15 tons p.a. Farm Manure + H.G. Supers + Potash
2. Maize
3. Maize + 200 lbs p.a. Bone & Supers
4. Edible canna
Cb 1. Maize + 8 tons p.a. Farm Manure
2. Maize
3. Dolichos beans for hay + 200 lbs p.a. H.G. Supers
D 1. Dolichos beans + 200 lbs p.a. Rock phos. ploughed under
2. Maize + 150 lbs p.a. H.G. Supers
3. Maize + 200 lbs H.G. Supers & 100 lbs Muriate of potash p.a.
4. Maize + 150 lbs p.a. H.G. Supers
E 1. Sunn hemp for seed
2. Maize + 200 lbs p.a. H.G. Supers
3. Maize + 100 lbs Rock phos. + 50 lbs Muriate of potash
4. Maize + 200 lbs p.a. Bone & Supers
F 1. Sunn hemp ploughed under
2. Maize + 200 lbs p.a. Bone & Supers
3. Maize + 200 lbs p.a. Bone & Supers
4. ½ Sunflower, ½ Linseed
G 1. Sunflower + 200 lbs p.a. Rock phos. ploughed under
2. Maize
3. Maize + 200 lbs p.a. Bone & Supers
4. Ground nuts + 150 lbs p.a. potassic Supers

The Gwebi Demonstration Farm.

By the CHIEF AGRICULTURIST.

The Government Demonstration Farm, Gwebi, is situated about 18 miles from Salisbury and lies on either side of the Salisbury-Sinoia railway line and main road. The farm is 3,632 acres in extent, of which about 850 acres are in arable and about 2,300 in pasture, the remainder being occupied by building sites, roads and timber plantations.

Past History.—In the early days of the British South Africa Company's administration of the Colony the property was reserved for afforestation purposes and was known as the Gwebi Forest Reserve. Up to 1909, however, no development work of any kind had been undertaken, with the exception of the planting of a few eucalyptus, mulberry and other trees.

In 1910 a commencement was made in opening up arable land, and from then onwards until 1922 these lands, as developed, were utilised for testing out on a field scale the lessons in respect to crops and arable land management gradually learnt from small plot investigations on the Salisbury Experiment Station. Field work principally took the form of (a) practical experiments to ascertain the best means of maintaining soil fertility by rotation of crops and green manuring; (b) experiments on a large scale to test the suitability of new crops introduced to the Colony, and (c) bulk propagation to produce seed or other propagating material of more promising crops and varieties for distribution throughout the country. The popular and well known breed of maize—Salisbury White—was concentrated upon and standardised, and improved seed of this and of Hickory King was produced in bulk for sale to farmers at reasonable prices. Extensive variety trials with other kinds of maize were also conducted, and valuable information in regard to

their suitability or otherwise to local conditions was thus obtained.

Live Stock.—As time passed, elementary investigations into live stock questions—in keeping with the agricultural development of that period—were commenced. Native and Angoni cattle were tested as milk producers and were crossed with pure-bred bulls of European breeds, and a small flock of Merino sheep was introduced and maintained with varying success for a number of years.

In 1914 a portion of the Friesland herd disposed of on the death of the late Mr. A. J. Maclaurin, of Pomona Farm, was purchased, and thus were begun the first commercial dairying operations on the farm. A year later was undertaken what is believed to have been the first stall or yard fattening of bullocks for beef production in Rhodesia. The steers available for fattening in those days were very different from the fat stock seen on our local shows to-day, but fattening for beef was persevered with and has been continued ever since, a considerable number of reports on the subject having been issued from the farm.

The useful functions which the Gwebi Farm performed in the above directions—while agriculture in Rhodesia was still very much in its infancy—are often to-day forgotten.

Progress on the live stock side, however, was constantly handicapped by lack of funds. The annual grant for maintenance and development for many years was only about £1,000, and all income earned by the farm reverted to revenue.

The first Friesland herd was purchased with funds provided by the British South Africa Company in its commercial capacity, and the animals remained the property of the Company, not of the Administration. The herd was not altogether a success and was disposed of after four and a half years, the proceeds of the sale being paid to the Company.

Recent History.—On the advent of Responsible Government the fate of Gwebi remained uncertain for some months, but towards the end of 1924 it was decided to continue its operations for the future as a demonstration farm, conducted as closely as possible on commercial lines. It was provided

with its own banking account, into which in 1925 a sum of £2,000 was paid by the Treasury to defray expenses during that year, all revenue earned from that date onwards to be retained by the farm for its own use. Since then the Gwebi has been self-supporting except for the salaries of the staff, which have been paid from Votes, and a total sum of £12,946, which has been provided from Loan Funds for capital expenditure on the purchase of pedigree live stock, the erection of buildings and fencing, development of water supplies and so forth.

Friesland Herd.—The beginnings of a second Friesland herd were laid in 1925, when twelve pedigree cows, sixteen grade cows and heifers and a pedigree bull were purchased, and since that date sixteen pedigree bulls have been bred and sold to local farmers. The average milk yield of the herd is about two and a half gallons per diem per cow over the lactation period.

The sheep flock was augmented in 1925 and 1926 by small numbers of Wool Persians and Black Head Persians, but sheep have not proved really successful, and the flock was disposed of during 1928-29.

Pigs.—Middle White pigs—amongst the first in Rhodesia—were imported in 1925 and were employed in producing pedigree stock of this breed for sale and for crossing with Large Black sows for bacon production. Although Middle Whites were found to be a satisfactory breed, it was considered that Large Whites might prove better, and with a view to bringing new and improved blood into the Colony, three sows and two boars each of the Large White and Large Black breeds were imported from England in 1930, the Middle Whites being sold off.

Shorthorn Cattle.—In July, 1929, two pedigree bulls and ten heifers, representative of the best beef Shorthorn blood in Great Britain, were added to the live stock side of the farm, the intention being to breed, in addition to Frieslands, pedigree Shorthorn bulls for sale and grade Shorthorns for beef production. Forty grade Shorthorn heifers were recently purchased with the latter object in view.

Farm Costings.—Meanwhile, however, it had become apparent that the working of the Gwebi as a demonstration

farm would be of little practical value to the Colony unless costings—which could be made available to the farming community—were simultaneously kept. Some delay occurred before a costing system could be introduced, and at first an attempt was made by the farm staff to undertake these duties. This, however, placed too great a burden on the farm manager and also failed to provide a sufficient check on the final figures. From the 1st October, 1928, improvements in this direction were effected. The farm office is now responsible for all allocations of expenditure on labour, materials, foodstuffs and so forth under the various headings provided, and these records are submitted monthly or oftener to the office of the Accountant, Department of Agriculture, where the books are kept and where these returns are translated into pounds, shillings and pence for costing purposes. Much valuable information is being made available in this manner, the first reports on the financial working of the farm having been published at intervals in the *Rhodesia Agricultural Journal* during 1930.

Present Conditions.—Side by side with the expansion indicated above, development in all other directions has continued. The farm has been fenced into fourteen paddocks, of which eight are provided with permanent water supplies by means of boreholes, while four others are naturally supplied by the Gwebi River. Afforestation has been proceeded with; five of the above paddocks have been entirely surrounded with wind belts of eucalypts, and in addition thirty-six acres of gum plantations have been established.

A new cow-byre planned on modern lines, to accommodate 48 cows, has recently been completed at a cost of about £1,600, and many other building improvements have been effected.

The live stock on the farm on the 30th September, 1930, was as follows:—

Pedigree Frieslands	53
Grade Frieslands	68
Pedigree Shorthorns	16
Grade Shorthorn heifers	40
Store bullocks (2 to 3 years old)	38
Fattening bullocks	37
Trek oxen	158
Pigs (all ages)	117

The milk and butter fat returns of all dairy cows are regularly recorded, as also are the rations fed to all live stock. Milk production averages over 100 gallons a day, but to avoid conflicting with the interests of local farmers, the milk is not converted into butter or cheese or sold as whole milk into Salisbury, but is separated and the cream sent to the local creamery depot.

Forty to seventy head of bullocks are stall fattened each year, some of which are usually shipped on the hoof to Great Britain, while the remainder are marketed in the Union of South Africa or locally. Between 500 and 600 tons of farm manure are required each year for the lands, and the fattening of bullocks materially assists the dairy herd in producing this large amount.

Arable Lands.—The arable lands of the farm comprise between 800 and 900 acres, mostly of red clay-loam character, but with a small area of black and yellow vlei soil. This area is divided into convenient sized fields or blocks of varying dimensions, the majority of which are worked under different systems of rotation, manuring and fertiliser treatment. A reference to the diagrammatic plan of the lands will indicate the arrangement of the fields and the acreage of each. Capital letters and brackets indicate the sub-divisions falling into one rotation system, and at the side of the plan will be found particulars of the cropping methods to be followed in each rotation from 1930-31 onwards.

As live stock increased, amendments in the original plan of cropping and fertilising have been necessary. From the year 1912 until 1924 Blocks A to C were occupied by various small scale rotation experiments, on which farm manure and fertilisers were used very sparingly, but the regular rotation of crops helped materially in maintaining fertility and so prolonging the useful life of these fields.

Commencing in 1926 and until the end of the season 1929-30, the following were the systems adopted:—

Block A.—Maize and beans for silage and maize for grain, both with 150 lbs. bone and supers per acre, dolichos beans for hay, maize with 8 tons farm manure per acre, part sweet potatoes, part edible canna.

Block B.—Maize with 150 lbs. high grade superphosphate per acre, dolichos beans for hay, maize with 6 to 7 tons farm manure per acre, ground nuts with 150 to 200 lbs. high grade supers per acre.

Block C.—Maize with 150 lbs. per acre bone and supers, sundry crops including potatoes with farm manure and artificials, oats, sunflower, edible canna and dolichos beans for hay, all with 150 lbs. bone and supers per acre, maize with 6 to 8 tons farm manure per acre, maize untreated.

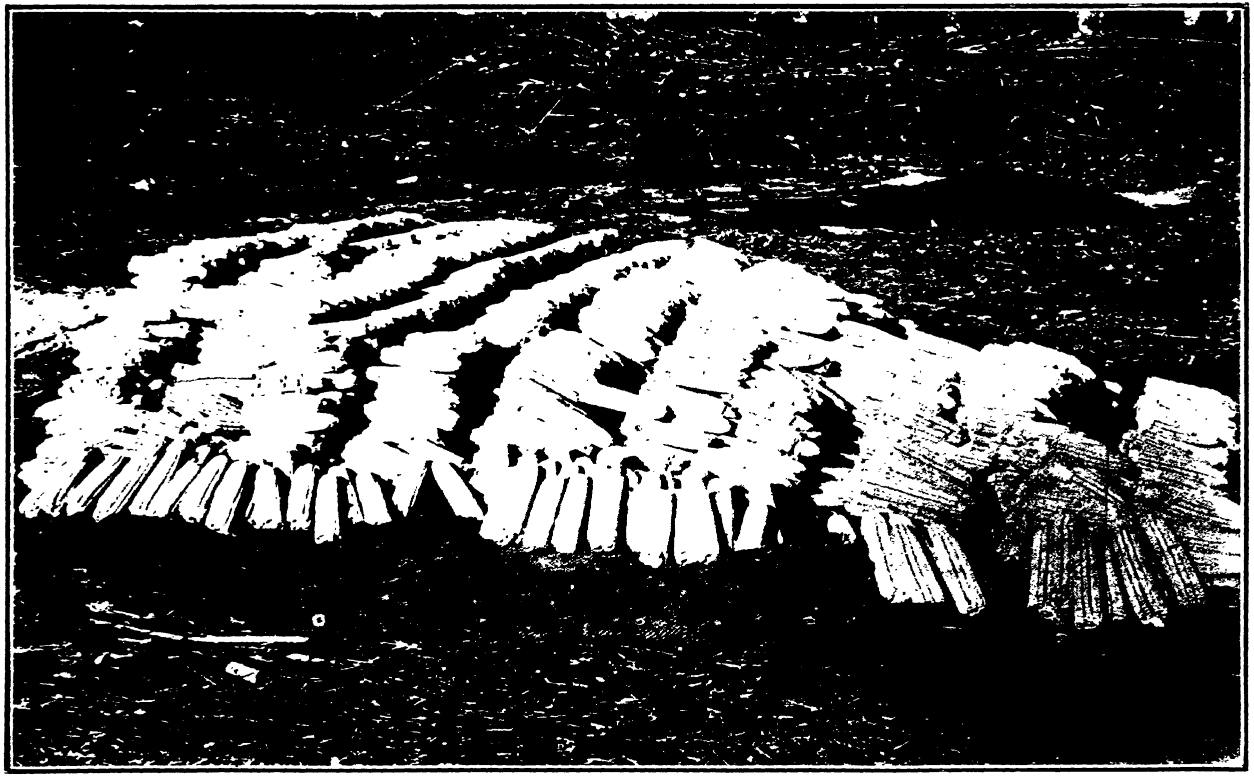
Block D.—Beans for hay or ploughed under, maize with 150 lbs. bone and supers per acre, maize with 150 lbs. bone and supers per acre, maize with 200 lbs. bone and supers per acre.

Block E.—The whole area was under maize during the seasons 1925-26 and 1926-27. From the following season until 1929-30 the cropping system was Sunn hemp for seed, maize with 200 lbs. per acre bone and supers, maize untreated.

Block F.—Grew maize and ground nuts in 1925-26 and maize with 150 lbs. bone and supers per acre and small areas of oats, manna and Sunn hemp for seed in 1926-27. From that date until 1929-30 the cropping system was: maize with 150 lbs. bone and supers per acre, sunflower and linseed without treatment, Sunn hemp ploughed under.

Block G.—Sub-divisions Nos. 25, 26 and 27 grew two-thirds maize and one-third sunflower without treatment in 1925-26. In 1926-27 sub-division 25 grew maize without treatment, 26 grew maize with 150 lbs. per acre bone and supers, and 28 grew ground nuts with 150 lbs. per acre bone and supers. Sub-division 28 was cropped for the first time in 1927-28, and since then the cropping system has been: maize with 150 lbs. per acre bone and supers, maize with 200 lbs. per acre bone and supers, dolichos beans for seed.

Under the above systems of cropping and fertilising, the maize yields per acre—making due allowance for variations in season—have been well maintained. Prior to 1925 the average yield was 6 to 7 bags an acre, with occasional sections yielding somewhat more. From that date onwards, and due to the increased use of farm manure, artificial fertilisers and green manure crops, the returns have been as follows:—



Selecting Salisbury White seed, Gwebi Farm, 1915.

Bird's eye view of Broadbalk lands on Farmers' Day.

Tractor trials with producer-gas plant, Gwebi.

Maize yield,	1925,	over	345	acres:	9	bags	an acre.
,,	1926	,,	340	,,	9.7	,,	,,
,,	1927	,,	332	,,	11	,,	,,
,,	1928	,,	412	,,	11.6	,,	,,
,,	1929	,,	414	,,	9.06	,,	,,
,,	1930	,,	467	,,	10.6	,,	,,

Average yield over 6 years, 10.15 bags an acre.

The season 1928-29 was an unfavourable one for the farm. The average yield that year for the whole Colony was 5.61 bags an acre, and that for the district with the highest average yield was 6.5 bags an acre.

It is not, however, considered that these yields have yet been raised to an economic level, and for this reason: the cropping and fertilising systems to be followed from 1930-31 onwards provide for heavier and more frequent applications of fertiliser. The costings kept will indicate whether this extra expense is justified or not, but it is confidently anticipated that when the various fields have received their second dressing of farm manure or second green manuring, as the case may be, the average yield of maize will be increased to 12 or more bags an acre and the yield of other crops proportionately.

Experiments on Behalf of the Rhodesia Agricultural Union.—Fields Nos. 29 to 37 are each 10 acres in extent and are under commercial field trials conducted at the request of the Rhodesia Agricultural Union and the Maize Association. Particulars of these are as follows:—

On Fields Nos. 29 and 30 identical cropping systems are followed, namely, dolichos beans ploughed under, followed by three crops of maize, 400 lbs. per acre of rock phosphate being applied to the land over the four years. The difference in treatment lies in the fact that on Field No. 29 one of the 200 lbs. per acre phosphate dressings is applied to the dolichos bean crop to be ploughed under, while on No. 30 both rock phosphate dressings are applied direct to the maize crop.

Fields Nos. 31 and 32 are also worked under identical systems of cropping, namely, maize with 200 lbs. of phosphatic fertiliser per acre, sunflower ploughed under, maize with 200 lbs. rock phosphate per acre, maize untreated. But

on Field No. 31 the rock phosphate each time is applied broadcast and harrowed in, while on No. 32 the similar fertiliser is applied by means of the fertiliser attachment on the maize planter.

On Fields Nos. 33 and 34 and on Fields Nos. 36 and 37 identical dressings of (a) bone and superphosphate and (b) high grade superphosphate are applied at similar intervals and by the two different methods mentioned above, the whole series thus providing a test of the relative merits of rock phosphate compared with bone and supers and high grade superphosphate, and also of the advantage or otherwise of applying the fertiliser in the drill with the seed as against broadcasting and harrowing it under.

Field No. 35.—Here 200 lbs. per acre of rock phosphate is applied to two of the three maize crops, but the fertiliser is ploughed under in winter several months before the maize is planted. This field works in with Fields Nos. 31 and 32, where the green manure crop is also sunflower, but where in one case the rock phosphate is broadcasted and harrowed in, while in the other it is applied by means of the fertiliser attachment.

No regular systems of treatment have as yet been laid down for Field No. 38 and onwards.

Other Crops.—The Gwebi possesses no soil considered suitable for the production of bright tobacco, nor are conditions thought to justify the growing of heavy, fire-cured leaf. Cotton has been repeatedly tried, but so far without success, possibly owing to the rather cold and exposed aspect of the lands. The principal crop is maize, and crop revenue is mainly derived from this source. Other saleable crops produced on a smaller scale are potatoes, ground nuts, sunflower and linseed. Carefully cleaned and selected seed of these crops is produced annually and available for sale. Maize and bean silage, dolichos beans for hay, sweet potatoes, edible canna and ground nuts and sunflower are grown for stock feed.

Organisation and Staff.—The farm since its inception has been under the direction of the Chief Agriculturist, the resident staff at present consisting of the manager, a stockman, a field assistant and an accounts keeper. The salary of the

last-named is met from farm funds. The number of native labourers employed usually ranges from about 80 to 110.

A number of married quarters are provided for new settlers who, by arrangement with the Department of Lands, may take up residence to acquire local experience. When accommodation permits, already established farmers or others wishing to study special aspects, such as dairy farming or pig-keeping, on this class of land, can also be accepted for short periods, being required only to defray their own boarding fees.

Those in immediate charge of the farm since 1910 have been as follows:—

1910-12: Mr. A. Alder, Farm Foreman.
1912-14: Mr. H. G. Heywood, Farm Manager.
1914-25: Mr. J. H. Hampton, Farm Manager.
1925 onwards: Mr. E. E. Wright, Farm Manager.

Notice.

The attention of importers, manufacturers and vendors of fertilisers and farm foods is drawn to Government Notice No. 132, 19th March, 1920, setting forth the regulations regarding the sale of fertilisers, farm foods, seeds and pest remedies.

It should be noted that in future these regulations will be rigidly enforced, and any person contravening them renders himself liable to prosecution.

Studies on the Improvement of Natural Veld Pastures.

No. 2.

By A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc.,
Chemistry Branch, Department of Agriculture.

"Grass bears no blazonry of bloom to charm the senses with fragrance or splendour, but its homely hue is more enchanting than the lily or the rose. It yields no fruit in earth or air, yet should its harvest fail for a single year famine would depopulate the world."—*Farm Notes*, October, 1930.

The question of the conservation, management and possible improvement of natural pastures is of great importance to every agriculturist and stock breeder in Southern Rhodesia. In spite of the fact that in many areas of the country the quantity factor of the grazing appears ample, experience has taught stock breeders that high grade or pedigree cattle rapidly lose their productive capacity if left to graze on the veld without supplementary feeding. It is also recognised that even scrub stock in many parts of the country require supplementary mineral feeding in order to keep them in good health, and it is fully realised by the majority of farmers that there is apparently some deficiency in the natural grazing.

Chemical analysis of the veld herbage shows that the protein and mineral contents of the ordinary veld grasses are considerably lower than those of improved pastures in Europe, which is the type of grazing to which the imported stock have been accustomed and which they require if they are to maintain their productivity.

It is a known fact that unless pastures in Europe receive proper management and manurial treatment they rapidly

deteriorate, and it is also known that in certain cases sheep grazing on unmanured hill pastures are prone to suffer from certain diseases associated with dietetic deficiencies unless periodically driven down and allowed to graze on richer lowland pastures. These facts clearly demonstrate that only by careful methods of pasture management and attention to manurial treatment is it possible, even in Europe, to maintain the productivity of high-producing animals and to make stock-raising an economic proposition. It is very little wonder, therefore, in Africa, where practically no attention or consideration is given to the natural pastures, that these animals when placed upon the veld are found to lose their productive capacity. The probability that many of the difficulties connected with stock-raising experienced in this country may be due indirectly to faulty nutrition is evidenced by the great improvement in health resulting from the feeding of protein and mineral supplements to grazing animals in many parts of South Africa. The question as to whether it is more economic to feed the minerals to the animals direct or to endeavour to influence the protein and mineral content of the grasses by application of mineral fertilisers to the soil has, however, received very little attention.

It is generally considered that fertilisation of natural veld pastures cannot be economic, although no experimental work to determine this has ever been carried out. It has been established quite definitely that fertilisation of arable land is economic, and it is difficult to understand, therefore, why fertilisation of grassland, at least in certain circumstances, should not also prove so. The fact that investigational work has already shown us that fertilisation of grassland not only increases the quantity, but also improves the quality, and hence is bound to reflect itself on the health and productive capacity of the animal, must be taken into consideration in studying the economics of the problem. In many cases the value of the cattle lost through so-called "poverty" would, had it been possible to keep them alive, have paid the cost of fertilisation of many acres of grassland. The degree to which animals suffer from malnutrition on poor or deficient pastures is dependent mainly upon their rate of growth and productivity. Pastures suitable for small and slow-growing native stock may be entirely unsuitable for rapid-growing and high-producing

grade or pedigree stock. Although it may not be economic to fertilise pastures for scrub cattle costing about £3 to £5 per head, it may be economic to fertilise for grade or pedigree beasts costing anything from £10 per head upwards.

The efforts of present-day stock breeders in Africa to evolve higher producing animals than the native stock make the problem of the improvement of the natural veld grasses one of extreme importance. Although in some cases it may be necessary and more practicable to feed minerals in the form of licks to the animals, it must not be forgotten that such methods exercise but little influence on the carrying capacity of the land and cannot be expected to correct or improve the palatability, digestibility or nutritive value of the grazing. All of these factors are influenced by treatment of the soil, and there is no question but that the best method of increasing the mineral intake of animals grazing on mineral-deficient pastures is to increase the mineral content of the grasses by enriching the soil. By this method the quantity factor is increased, the minerals are given in the form that will ensure the maximum assimilation by the animal, and at the same time the feeding value of the grass is increased in other ways.

In addition to the question of fertilisation, there is the all-important problem of methods of veld management. The practice of ranging cattle the whole year round may be suitable for native and scrub stock, but certainly is not suitable in most parts of the country for high grade stock. Recent research on pastures in Great Britain has demonstrated that the period of the maximum feeding value of a pasture can be controlled partially at least by methods of pasture management, and that this value varies according to the stage of maturity of the plant and the incidence of the rainfall. The results of a recent experiment carried out at the Salisbury Experiment Station show that the feeding value of the veld grass, as judged by chemical analysis, rapidly falls after the rains have ceased, and that one ton of hay cut at the beginning of April is equal in food constituents to two tons cut in May.

This finding alone means that even on very poor pasture the cutting of the grass for hay at the correct time of the year results in a product having twice the protein content of

the grass left standing on the veld. Were farmers to adopt this practice it would probably mean that their losses of stock from "poverty" would be reduced considerably and that in many cases grass having a minus feeding value would be converted into hay with one at least sufficient to supply maintenance.

Investigatory work into problems of veld management in Africa should produce results of great economic importance and should enable us to utilise to a far greater extent the potential food material contained in the vast areas of grazing land throughout the country.

In a previous paper published in the *Rhodesia Agricultural Journal* in September, 1928, reference was made to the fact that numerous experiments in other countries had shown that the feeding value of grass may vary considerably, according to its stage of maturity. It is a fact well recognised by farmers in Southern Rhodesia that at the beginning of the rainy season cattle grazing on the veld rapidly improve in condition, although the amount of young grass is limited, whereas at the end of the rains, although the quantity factor of the grazing is ample, cattle rapidly fall off in condition.

The system of pasture management known as "close-grazing," which has received so much attention from agricultural research workers in Europe, has demonstrated the high nutritive value of young grass as compared with mature grass and has shown that by a suitable system of rotational grazing the carrying capacity of pasture land may be considerably increased. In order to ascertain the difference in the feeding value of veld grass during each month of the year a series of analyses of the veld herbage has been carried out in the chemical laboratories on the same plots used for the experiment detailed in the report previously mentioned. In addition to these analyses it was decided to mark off several small areas on the plots which were to be cut regularly each month, with the object of simulating rotational grazing, in order to demonstrate the difference between the nutritive value of the short young grass and the ungrazed and more mature grass.

It will be seen from the results detailed below that the probability suggested in the previous article—that the feeding value of our grasses is much lower during the latter

part of the rainy season than during the early part—is borne out by the analysis of the grasses cut later on in the season.

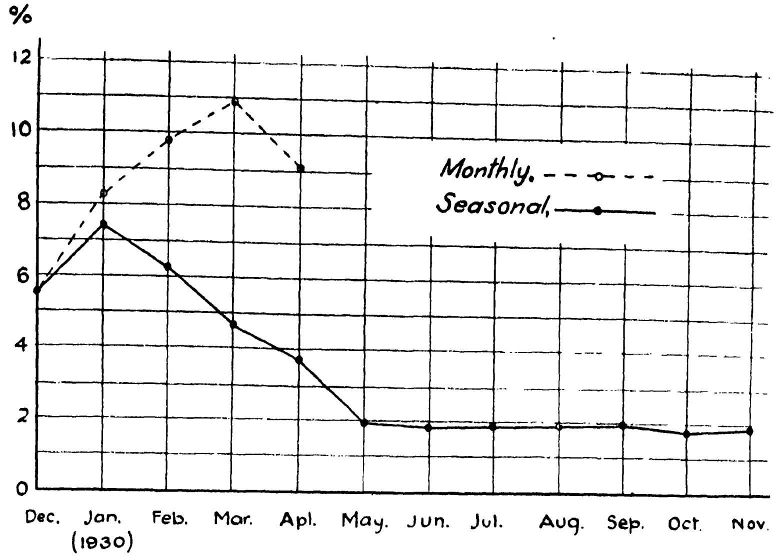
The plots received no further manurial treatment after the season 1928-29 than that detailed in the article mentioned ("The Importance of Research on Pasture Improvement in Southern Rhodesia," *Rhodesia Agricultural Journal*, September, 1928). The last application of fertiliser was therefore given in November, 1928, and although it is not intended to stress the point in this further article, the residual effects are still noticeable, both in the quantity and the quality factors. Let it suffice to call particular attention to the former, with the undernoted figures.

TABLE I.

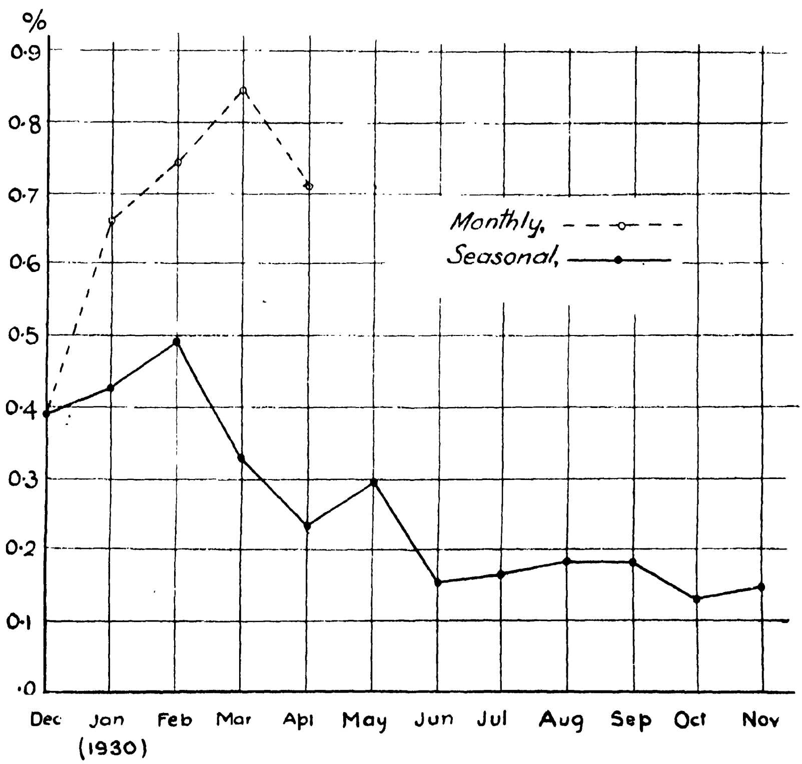
	1929 yield of hay per acre. Lbs.	1930 yield of hay per acre. Lbs.	Total yield per acre for 1929 and 1930. Lbs.	Increase over control for 1929. Lbs.	Increase over control for 1930. Lbs.	Increase over control for 1929 and 1930. Lbs.
Nitrate of soda + potash + super	3,492	2,600	6,092	2,084	1,386	3,470
Sulphate of ammonia + potash + super	2,900	2,166	5,066	1,492	952	2,444
Control (no fertiliser)	1,408	1,214	2,622	...	...	...

The figures showing the marked increase in bulk of hay as the result of one average application of fertiliser in two years require no comment, speaking as they do for themselves. It was originally intended to repeat cutting and weighing for at least one more year, but owing to building requirements the ground is unfortunately no longer available.

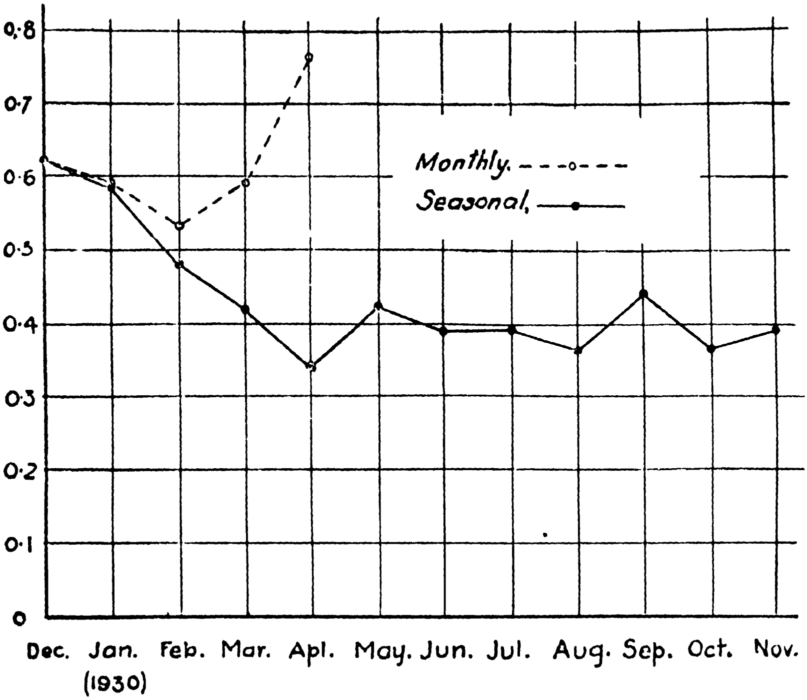
Experimental Procedure.—The chemical analyses were again made on all three plots, but as our intention here is



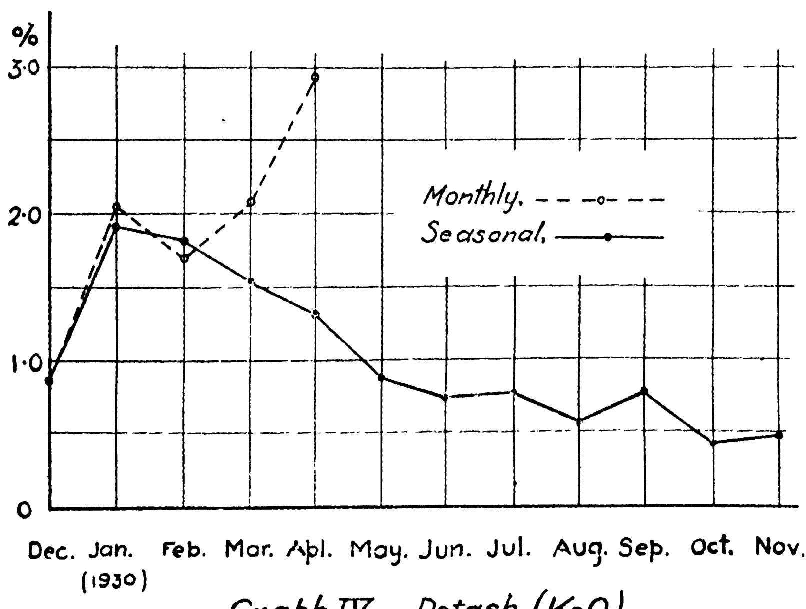
Graph I, Crude Protein



Graph II, Phosphoric Oxide (P_2O_5)



Graph III: Lime (CaO)



Graph IV, Potash (K_2O)

to demonstrate the value of close-grazing as compared with the usual method adopted of allowing the pasturage to mature, the tables below show only the results from the best of the three plots, that which received nitrate of soda. Equally as convincing and very similar contrasts were, however, obtained from the remaining two plots, but to avoid any possible confusion of the issue these are not reproduced.

Six yard-square quadrats were staked out, two on each area, and from these were obtained the samples of monthly cuttings for analysis. The cuttings were made by hand by means of a pair of shears on the 7th of each month, from 7th. December, 1929, onwards. Previous to cutting, all weeds were removed, as observations have shown that stock graze these only slightly, and the grass was clipped as low as could conveniently be managed in order to simulate very close paddock grazing. It was well-nigh impossible to avoid including particles of grit and sand with the samples, so after air drying for several days the material was well shaken over a 3 mm. sieve and, all particles of extraneous matter having been removed, was ground to a powder in an electric grinder, bottled and analysed.

Simultaneously with these cuttings, corresponding ones were made alongside on the veld grass allowed to grow naturally, care being taken throughout that no two samples were ever obtained from the same spot. These samples were treated in every way similarly to the above, and represent ordinary ungrazed veld herbage. This part of the experiment was carried out throughout the complete period of twelve months, the last cutting taking place on 7th November, 1930. The close-grazing cuts had to be discontinued after that on 7th April, 1930, when, owing to the cessation of the rains and the consequent end of the growing season, there was insufficient material remaining for the purpose of analysis.

In the tables below all results are calculated as percentages on 100 per cent. dry matter.

TABLE II.

Composition of Grass of one month's growth only—corresponding to close-grazed veld.

Rainfall for preceding month.	Date of cutting.	Ash.	Acid-soluble ash.	Ether extract.	Fibre.	Nitrogen.	Crude protein.	True protein.	Lime (CaO).	Phosphorus (P_2O_5).	Chlorine (Cl).	Potash (K_2O).	Nutritive ratio.
Inches.		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent	Per cent.	Per cent.	
8.00	7.12.29	12.21	3.39	2.14	37.03	0.87	5.44	5.16	0 624	0.388	0.223	0.86	15.7
3.52	7.1.30	9.70	4.48	2.33	30.07	1.32	8.25	7.50	0.598	0.659	0.246	2.04	10.3
5.10	7.2.30	12.61	4 58	1.71	34.61	1.57	9.82	7.95	0 531	0.740	0.486	1.71	8.1
4.82	7.3.30	12 58	5.40	1.93	32 44	1.73	10.79	9.68	0.585	0 841	0 395	2.08	7.3
0.85	7.4.30	13 35	5.52	2.16	29 76	1.46	9.09	7.18	0.765	0 707	0.421	2 93	8.3

TABLE III.

Composition of Ungrazed Grass from month to month.

Rainfall for preceding month.	Date of cutting.	Ash.	Acid-soluble ash.	Ether extract.	Fibre.	Nitrogen.	Crude protein.	True protein.	Lime (CaO).	Phosphorus (P_2O_5).	Chlorine (Cl)	Potash (K_2O)	Nutritive ratio.
Inches.		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent	
8.000	7.12.29	12.21	3.39	2.14	37.03	0.87	5.44	5 16	0.624	0.388	0.223	0 86	15.7
3.520	7.1.30	10.93	4.61	2.17	32.23	1.18	7.40	6.07	0.591	0.425	0.375	1.92	11.4
5.100	7.2.30	10.68	4 94	1.35	38.00	1.01	6.33	4.90	0.477	0.494	0.425	1.81	13 4
4.820	7.3.30	8.13	3 80	1.34	43.61	0.76	4.73	3.44	0.421	0.328	0.248	1.53	18.8
0.850	7.4 30	7.18	3.06	1.24	43.67	0.60	3.72	2.85	0.336	0.235	0 176	1.34	24.4
0.330	7.5.30	6.57	2.35	1.86	42.71	0 31	1.95	1.82	0.422	0.297	0.154	0.88	48.2
...	7.6.30	7.88	2.04	0.95	44.67	0.30	1.89	1.45	0.386	0.151	0.138	0.76	48.4
0.060	7.7.30	7 29	2 04	1.13	44.31	0.31	1.92	1.47	0.392	0.162	0.110	0.77	48.0
...	7.8.30	7 57	2.69	1.34	40.60	0.31	1 93	1.86	0.358	0.181	0.278	0.58	47.9
...	7 9 30	8.50	3.11	1.07	42.49	0.32	1.99	1.89	0.435	0.181	0.170	0.79	45.4
0.125	7.10.30	7.25	2.09	0.98	43.70	0.28	1.73	0.93	0.365	0.126	0.119	0 41	53 4
...	7.11.30	7.34	2.07	0.68	42.21	0.29	1.84	1.06	0.392	0.147	0.093	0.46	50.0

Analysis and Discussion of Data.—*Crude Protein.*—There are two striking points of interest with regard to this. The first is the lamentable one that in neither of the two series does the protein content at any time approach that of an average European grass. Cruickshank, in her studies into the seasonal variations of pastures, gives the figure of 20.8 per cent. for her "Good Pasture" and 10.9 per cent. for the "Poor Pasture." The highest result obtained by us, namely that for the monthly cut in February, 1930, was 10.79 per cent., a figure only exceeded in poverty by that of 8.37 per cent., which is the percentage content given in the records of the Rowett Institute for a sample taken from the Island of Lewis. Low though 10.79 per cent. is, however, compared with average European figures, it is almost 130 per cent. higher than the result obtained for the seasonal cut of the same date from the same plot, and 46 per cent. higher than the maximum for the year of the latter series, obtained from the January cutting, and this brings us to the second important point of interest.

Graph I. shows clearly the percentage of crude protein of the monthly cut herbage to be very markedly higher throughout than that of the grass allowed to mature naturally. Striking though the graph is, the figures are even more so, for the maturing grass shows an average of 5.52 per cent. for the months December to April, whereas the grazed grass gives 8.68 per cent., an increase of 57 per cent. It may at this point be observed that the average crude protein content for the whole twelve months of the grass allowed to mature amounted to only 3.4 per cent., but the nature of the experiment did not permit of a direct comparison being made in this respect with the other series, except that, were our five months grazed samples distributed over the whole year, the average would be 3.6 per cent.

Phosphoric Oxide.—Whether there is any direct relationship between the seasonal variations of the contents of phosphoric oxide and of crude protein is a matter which will require, and which must receive, further investigation, but when Graph I. (crude protein) and Graph II. (phosphoric oxide) are compared, the similarity of the curves, as far as they go, is at once apparent. In the monthly cuttings in each case a decided upward gradient occurs for three months,

after which there is as distinctly a downward movement. In the seasonal samples, the same rise and fall is also evident in both, but here the crude protein reaches its apex after one month, whereas the culminating point for the phosphoric oxide is attained only after the second month has finished.

The results obtained for the phosphoric oxide content of the monthly samples are startling. The maximum is .841 per cent., obtained from the March sample, and this figure, apart from being the highest yet obtained from these plots, even when directly under the influence of fertilisation, is markedly higher than any one of those given in the Rowett Institute list already referred to, where the top figure is .74 per cent. from "cultivated pasture." It is 156 per cent. higher than the seasonal content of .328 per cent. for the same month, and 70 per cent. higher than the maximum seasonal content of .494 per cent. for the month of February. The average monthly content for the five months under review is .667 per cent., that of the seasonal cuts for the same period .374 per cent., a lead for the former of 79 per cent. The average for the year of the seasonal cuttings amounts to merely .259 per cent.

The exceedingly rapid drop from .297 per cent. in May to .151 per cent. in June, after which there is little variation, is due undoubtedly to the fact that most seeds containing a high percentage of phosphoric oxide have fallen to the ground in the intervening month, and so would not be contained, as previously, in the sample.

It is interesting to note that the young short grass shows no phosphorus deficiency, despite the relative phosphorus deficiency of the soil. In the more mature grass the phosphate content is certainly below that of pastures in Great Britain, but on the whole it cannot be stated that this pasture shows any marked deficiency of phosphorus until towards the end of the rainy season. One cannot, of course, state that on all pastures throughout the country the same relatively high phosphate content will exist, but taking European cultivated pastures as a standard, the pasture studied in this experiment shows a more marked relative deficiency of protein, potash and chlorine than of phosphorus.

Lime.—Graph III. shows the variations in the lime content. The monthly cuttings show a fairly rapid ascent

in the contents of this constituent, commencing with the cutting on 7th February, after which date the rainfall began to decrease, and continuing to the comparatively high figure of .705 per cent. in April, when these observations ceased. Czapek (1920), quoted by Henrici, in a resumé of the literature on the subject, states that a continuous increase of the calcium takes place with the advancing season. Henrici, for veld grasses of the Eastern Transvaal high veld, found the accumulation of calcium in autumn and winter distinct in nearly all her grasses, but that the increase was nowhere as much as in Europe. Our plots showed no such increase; there was a steady fall of calcium in our seasonal cuts from December (.624 per cent.) until April (.336 per cent.), after which, with slight rises and falls, the figure remained on an average of .39 per cent. This, however, is quite comparable with Henrici's results for her Eastern Transvaal grasses, but considerably lower than what is normally obtained from good British pastures. The average for our five monthly cuts was .62 per cent.

Potash.—A reference to Graph IV. and the potash figure in Table III. shows that there is a marked deficiency in this constituent of our grasses as compared with cultivated pastures in Great Britain, which average 3.18 per cent. The average for the growing period of five months in ours is 1.92 per cent. for the monthly cuttings, and 1.49 per cent. for the seasonal cuts, the former rising to the excellent peak of almost 3 per cent. in April, when the rains have well-nigh ceased for the season, as against 1.34 per cent. for the latter. The average for the rest of the year in the mature grass stands, however, at the low figure of .66 per cent. Except for a small inexplicable rise in September, there is a steady decline in the seasonal samples from the maximum of 1.92 per cent., which was attained in the January cut, to the very low figure of .41 per cent. recorded in October.

Chlorine.—The chlorine figures vary throughout the year, the only points of interest being that each series of cuts shows its maximum in the February sample, after which there is a variable but steady decline throughout the remainder of the year in the seasonal cuttings, whereas the monthly samples fell considerably in March, but rose slightly again in April. The content throughout is exceedingly low, compared with European natural pastures.

While the chlorine requirement of cattle is not at present known, it is probable that it is fairly high, owing to the fact that the chlorine is required by the animal in fairly large quantities for the production of hydrochloric acid in the stomach for digestive purposes. Even in Great Britain it is common practice to supply ordinary salt or rock salt to farm animals to satisfy a salt craving, and it is quite possible that the great craving of animals in this country for salty substances may be due to this deficiency of chlorine in our natural pastures.

Figures for sodium and magnesia are not given; the sodium content over all was found to be negligible, and the magnesia remained almost constant between .25 and .30 per cent.

Acid Soluble Ash.—This important estimation demonstrates probably more conclusively than any one of the others taken individually how the total soluble mineral content of the grass is improved by frequent grazing. Whereas there is a consistently steady increase from the first cutting until the end of the experiment in the monthly cuttings, there is as steady a decline in the other set, the result at the end of the year giving the remarkably low figure of 2.07 per cent. For June and July the total reached was only 2.04 per cent., comparing most unfavourably with 5.52 per cent. reached in the monthly cuts in April.

Ether Extract and Crude Fibre.—Little interest attaches to these. For the monthly cuts the ether extract remains constantly on the borders of 2 per cent., while in the other it descends almost uniformly from 2 per cent. to just below 1 per cent., finishing up in November with the low content of .68 per cent.

The crude fibre figures are on the whole higher than those obtained from the same plots for the two preceding years. This is evident in both sets of cuttings, but the monthly set at the end of its sampling had reduced its content to 29.8 per cent., whereas the seasonal had increased to 43.7 per cent. This was, however, only what was to be expected, but it is a point of interest that right throughout both sets of cuttings, with the one exception of the last seasonal cut, the fibre has uniformly increased as the ether extract has decreased.

Nutritive Ratio.—The nutritive ratios are, of course, calculated on crude nutrients only. The results are self-proclaiming. Hay cut in February has a ratio of 1: 13.4, its aftermath one of 1: 7.3. Hay cut in April has one of 1: 24.4, while a month later in May it has widened to 1: 48.2.

The average ratio for the five monthly cuts is 1: 10, for the corresponding five seasonal cuts 1: 16.7, and for the whole year of the latter 1: 35.4.

From the above results, one is fairly justified in concluding that by a suitable system of veld management, including rotational grazing, the nutritive value and the carrying capacity of natural veld can be greatly enhanced. As one would naturally expect from research that has been carried out in other countries, it has been found that the feeding value of young grass in this country is very much higher than that of grass which is allowed to mature. Evidence is produced to show that the feeding value of our grasses is largely dependent on the stage of maturity, and not solely, as is generally supposed, upon the season of the year and the incidence of the rainfall. This indicates one or two direct lines upon which it may be possible, without the expenditure of a penny in fertiliser treatment, better to utilise the natural grazing of the veld.

The first line of attack would appear to be the controlling of the grazing lands by a system of paddocking and rotational grazing. It is true that this means additional expense in the matter of fencing, but such expense is unavoidable and would undoubtedly prove to be justified when distributed over a number of years. The size of the paddocks would naturally depend upon the number of cattle carried, and no definite standard can be laid down with regard to this.

The second important point brought out in the above experimental work is the necessity of cutting the hay at the correct stage of maturity in order to make the best use of it. It is quite clearly shown that there is a considerable difference in the feeding value of grass from month to month during the growing season, and that the more the season advances the more rapidly the feeding value of the grass decreases.

From analytical data, it appears that the grass has its maximum feeding value during the month of

January. The volume of grass during this month of the year would, however, hardly pay for its cutting. Although there is a fall in the protein content of the grass between January and February, yet during the month of February it has a very much higher feeding value than during the month of March. As its volume is quite good in February, it would appear that when the season permits, this would be the most profitable time in the Salisbury district to cut hay. Where it is possible to cut in this month, one could expect quite a reasonable aftermath, which would be very valuable for grazing purposes. This finding must not be taken as the best time for the whole of the country, it having been noted from the pasture research going on in Matabeleland that the most profitable time in that area is about one month earlier.

Although one realises how difficult it is for the average farmer to find the time and labour in the middle of the rainy season for the cutting of hay, the fact still remains that the extra effort in doing so during this month would be amply repaid by the value of the hay obtained as compared with hay cut later in the season.

The finding that the feeding value of our grass is largely dependent on its stage of maturity indicates that on farms where it is impracticable to cut grass for hay during the month of February, attempts should be made to check the growth of the grass by grazing during the early part of the growing season, say until some time in January, and then allowing the grass to go to hay after this date. It could then be cut later on during the season, probably in the month of April, and still have a high feeding value. It is true, of course, that by this latter method the yield of hay would be considerably reduced, but there is no doubt that this would be offset by its increased value.

The analysis of the mineral content of the grass under the two systems shows quite clearly that the percentage of all the minerals is considerably higher in the grazed than in the ungrazed grass. The figures rather indicate that where such a system is practised there would be very little necessity to feed any minerals in the form of licks during the growing season. The high phosphate content of the short grass is a rather remarkable finding in view of the

phosphate deficiency of our soils and the general belief of all stock breeders that it is necessary to feed to all animals right through the year some form of phosphatic mineral lick.

The question of the value of mineral fertilisation of the veld is being further studied at the pasture research stations both in Matabeleland and Mashonaland, and it is hoped that at a future date it will be possible to make some definite statement and recommendations regarding this aspect of veld improvement.

SUMMARY.

From the results quoted and the analyses of these which have been made, the following points emerge:—

1. The bulk of hay obtained over a period of two years from a plot which received one normal dressing of complete fertiliser was 132 per cent. higher per acre than from a corresponding adjoining plot which received no fertiliser. In the latter plot the yield was just over 1¼ tons per acre; in the former it was just over 3 tons.

2. The crude protein content of the normal veld grass was found to be much below the standard of a natural average European grass. It was highest in January, with a total of 7.40 per cent., after which it rapidly declined to the miserable figure of 1.73 per cent.

3. Monthly clipped grass, intended to simulate close-grazing, gave much higher figures, rising to 10.79 per cent. crude protein at the beginning of March, and only falling to 9.09 per cent. in April, when the rains had virtually ceased.

4. The phosphatic content of the young grass, grazed monthly, was strikingly higher than that of the mature herbage. The former reached its summit in March with .841 per cent. phosphoric oxide, which is more than 2½ times the amount contained in the mature grass on the same date.

The phosphoric oxide in the mature grass was low throughout, decreasing rapidly after the dry season commenced.

5. The remaining mineral analyses indicate that our natural grasses suffer from a decided deficiency, but that this deficiency, though not so pronounced in the early part

of the season, becomes extremely so in most instances from the month of March onwards.

Further, by a system of close-grazing, the total mineral content steadily increases up to at least the month of April.

6. Ether extract is consistently low and crude fibre very high, but the latter lowers steadily under a close-grazing practice.

7. The nutritive ratio of the mature herbage widens from 1:11.4 at the height of the growing season in January to the appalling ratio of 1:53.4 in October, the average from May to November being 1:48.8.

On the other hand, the close-grazed quadrats show an average of 1:10, the ratio narrowing to the useful one of 1:7.3 in March.

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CRUICKSHANK, E. M. *Journ. Agric. Sci.*, Vol. XVI., Part I.

WANTED.

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Apply L. CRIPPS,
Cloudlands,
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The Application of Water in Irrigation.

By R. Hamilton Roberts, B.Sc. (Eng.),
Assistant Irrigation Engineer.

(The following article supersedes one of the same title published in the *Rhodesia Agricultural Journal* of February, 1921, above the name of Mr. A. C. Jennings, A.M.I.C.E., A.M.I.E.E., Government Irrigation Engineer, and which was reprinted as Bulletin No. 384.)

It is assumed in this article that the main portions of the scheme have been completed, and it is therefore proposed to deal only with the problems which arise once the water has been delivered at the land—problems which, if neglected, may easily ruin every prospect of the successful raising of crops. The expenditure of a certain amount of labour and trouble to ensure the proper preparation of land for irrigation will be handsomely repaid by the increased economy of water and labour which will later be achieved. By the careful design of the field works the water may be applied with the minimum of labour and maximum of ease, not only resulting in economy of money and temper, but also making it possible to cover a crop rapidly when a watering is urgently needed.

Definition of Terms.—*Main Furrow.*—The canal which delivers the water to the head of the land to be irrigated.

Distributary Furrow.—A minor channel for conveying water from the main furrow to serve sub-divisions of the land.

Field Furrow.—A small temporary channel led off the distributary and conveying the water direct on to the land.

Nature of Soils.—A proper understanding of the characteristics of the soil will largely assist in determining the manner in which the irrigation of a given piece of land can best be carried out, and in successfully adopting the method of application of water to the land in question. For example, in soil of open texture the field furrows should be shorter and closer together, so that the land can quickly be wetted without excessive absorption at the head-end. Where the soil is tighter it takes longer to absorb water, and the "lead" or length of field furrow can be increased and the water run more slowly over the ground. The nature of the sub-soil has an important effect on the irrigation of the land, and it is as well to ascertain its depth and character at the outset.

Bound up with the consideration of the soil are the questions of "brak" (alkaline salts) and drainage, which are both dealt with in a subsequent paragraph. These are serious problems, which are sometimes inevitable, but may often be reduced by strictly avoiding the evil practice of over-irrigation.

Soil erosion is an ever-present danger, especially with unskilled irrigators, who are always prone to use volumes of water which are too large on slopes which are too steep. Much of the irrigated land in Rhodesia is somewhat steep and the soil easily eroded, so that it is of the first importance that the stream of water should be no larger than the native can easily control.

Every care should be taken to avoid working the soil when it is wet, which produces a "puddling" and caking effect. It is of particular importance in irrigated land that it should be regularly green-manured in order to supply humus to prevent undue formation of lumps.

Levelling of Land.—Land in its natural state has seldom an even surface, although it may give that impression to the unpractised eye, and it is consequently essential to prepare the surface carefully before it will be possible to apply irrigation water uniformly. In levelling it is only necessary to obtain a series of gently sloping or level surfaces, and to remove hummocks and mounds which would otherwise be starved of water, and to fill up depressions into which water would collect to a detrimental extent.

The amount of levelling depends, of course, on the natural slope of the ground and on the method of irrigation, which in turn depends on the crop to be grown, and therefore the crop and system of irrigation should be decided upon before levelling operations are commenced. Levelling is seldom justified on very steep slopes or with shallow soils, and in these circumstances the land should either be avoided entirely or used only for ridged crops.

A variety of implements may be used for levelling, of which the "dam scraper" and "buck scraper" are well known and may be cheaply purchased or made. They are both suitable for relatively heavy work where the "haul" is not unduly long. The American-made "Fresno" scraper is better adapted for heavy grading and long hauls, but its use will seldom be justified in this country.

These implements will perform the initial or rough levelling, but it is advisable to go a step further to obtain a properly finished and even surface. For this purpose a "rectangular float" or "box leveller" can be cheaply made, consisting of a frame 6 feet wide and about 16 feet long, built of two 9 in. x 2 in. planks set on edge, and several cross-pieces which are faced with steel plates. A longitudinal foot-board placed on top affords a place for the driver to stand, and by shifting his position forward or back the action of the leveller can be regulated.

When filling up hollows sufficient soil should be placed to allow for settlement, which would otherwise cause a new depression. This is particularly important where a permanent crop is to be grown. In citrus orchards also, where it is impossible to level the land once the trees have been planted, any money spent on the initial levelling will be saved many times over by the increased facility of irrigation.

It pays to prepare the surface of fields for rapid and uniform irrigation, as a consideration of the following benefits resulting will show:—

(1) Larger yields of crops.
(2) Better quality of crops.
(3) Economical use of water.
(4) Saving in time and labour.
(5) Preventing deterioration or washing of the soil.
(6) Enhancing the value of the farm.

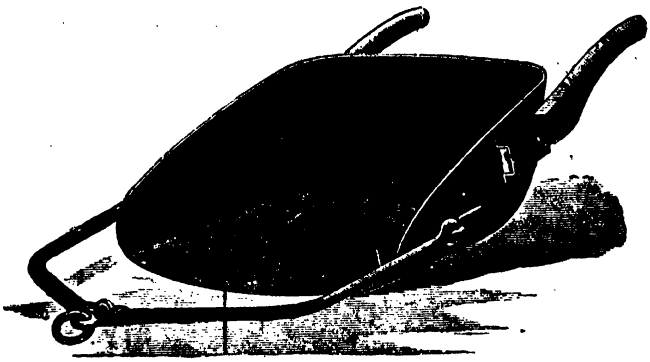

Fig. 1. Dam Scraper.

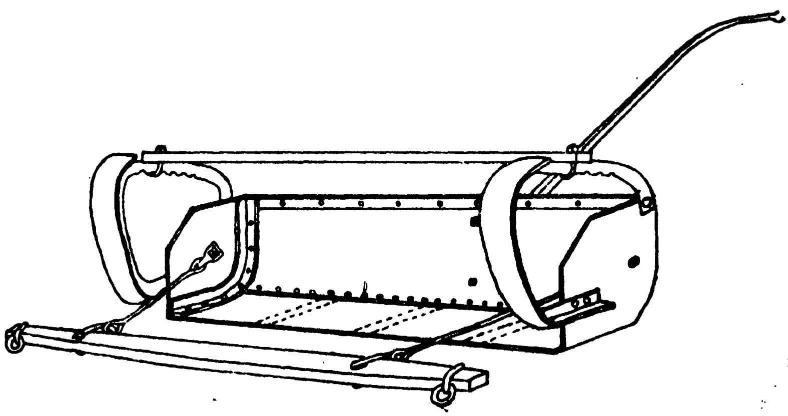

Fig. 2. Fresno Scraper.

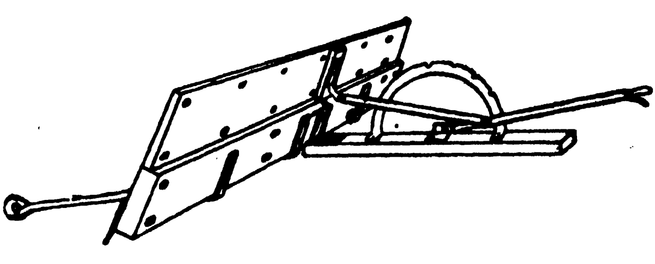

Fig. 3. Buck Scraper.

Methods of Irrigation.—The usual methods of applying water to land may be grouped under two general heads: the *flooding system* and the *furrow system*. The flooding system is especially used for the irrigation of "field crops" such as cereals, forage crops, grasses and others that do not require inter-tillage, while the furrow system lends itself to the irrigation of crops grown in rows, such as potatoes, tobacco, some garden crops and orchards. A combination of

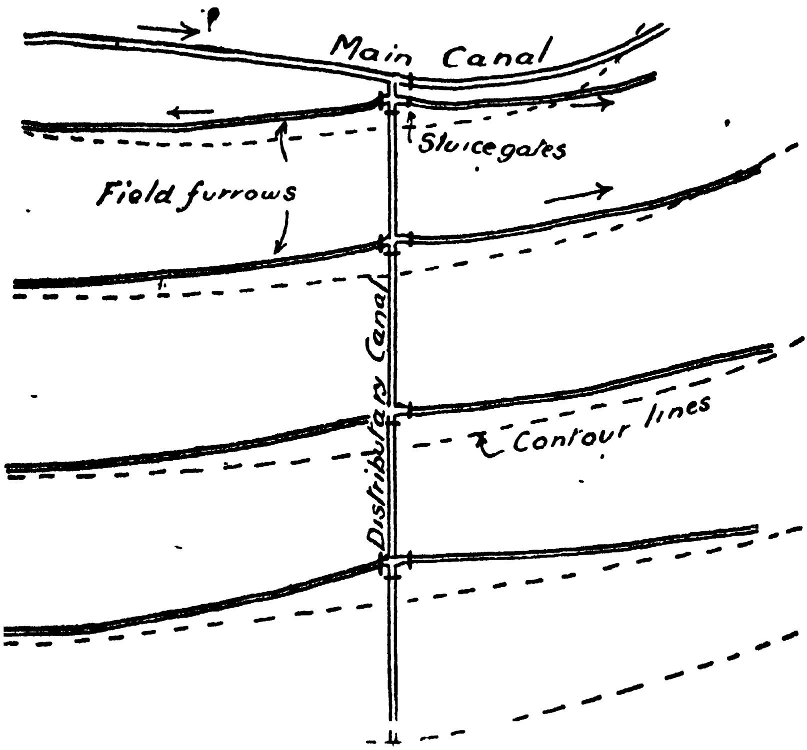

Fig. 4. Distribution by free flooding.

the two systems is sometimes used for orchards, and several other modifications exist.

A. Flooding System.—Free Flooding.—This system consists of leading off from the distributary a number of field furrows on a fall of about 1 in 500 across the field at intervals depending on the steepness of the slope, the areas between the furrows being levelled as previously described. The general lay-out is illustrated in fig. 4, but will vary in

detail for each individual piece of land. By means of temporary obstructions in the furrows the water is led out on to the land below, where it is distributed and controlled by the use of a shovel.

The method as often practised is exceedingly clumsy and inefficient, particularly if, as is often found, no attempt is made to level the ground, the application of water being anything but uniform, while the waste of water is exceedingly large. With skilful operation and careful preparation of the ground, however, good results may be obtained, and as quite a large "head" of water can be used, the field may be quickly irrigated.

The system is crude and wasteful of water and labour, and it is advisable to lay out the ground so that later it may be converted to the more efficient and economical system known as—

Flooding between Borders.—In this method the land is divided into long, narrow strips by means of low banks or borders. The strips are laid out to obtain a lengthwise fall (from the distributary end) not exceeding about 1 in 250. On very flat land it may be possible to lay out the strips down the steepest slope of the field without exceeding this rate of fall, but under Rhodesian conditions it will almost always be necessary to align them nearly parallel to the contours. It is essential that each strip shall be dead level in a crosswise direction, and this condition will control the width of the strips. On land sloping 1 in 30 the width should be about 20 feet, which means that 4 inches of soil must be removed from the upper side and 4 inches added to the lower side. On lands sloping 1 in 60 the width may be increased to about 40 feet, and the maximum width may be fixed at 50 or 60 feet.

A typical lay-out is shown in fig. 5, from which it will be seen that water is supplied from a distributary furrow which runs down the steepest slope. This distributary is permanent and is constructed of brick or concrete. A usual size would be 18 inches wide by 6 inches or 9 inches deep. Opposite the centre of each strip an opening 18 inches wide is made with grooves to receive an iron gate, which may be removed and placed in other grooves across the channel, thereby diverting the water out on to the strip

at the side. If the ground is properly levelled and graded and sufficient head is used, the water will flow slowly and uniformly several inches deep, as in a broad shallow canal, to the lower end of the strip. To avoid waste, the water should be cut off when it has travelled about two-thirds of the length of the strip, and a little experience will soon show just when this should be done.

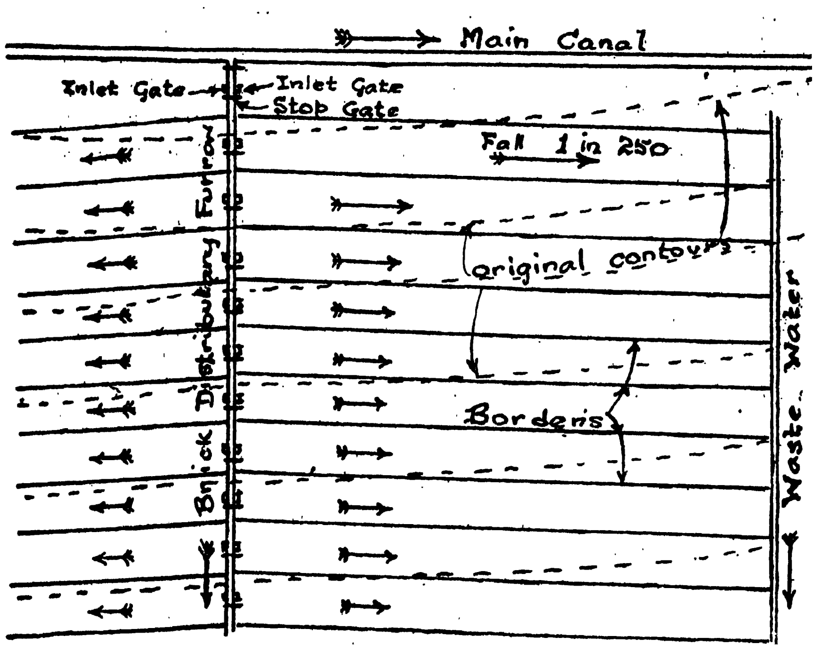

Fig. 5. Flooding between borders.

The length of the strips will depend largely on the nature of the soil, and may vary from 400 feet to 200 feet or less for light, absorbent soil. The "borders" should be made broad and low, at least 3 feet wide at the base and not more than 6 inches high when settled. They should be of an easy contour to enable implements to cross them without ill-effects. A useful home-made implement for construct-

ing the borders is shown in fig. 6, and is used in conjunction with a plough. The tops of the borders may be sown together with the rest of the field, so that no land is actually wasted.

This system can be widely applied to a variety of conditions, and will be found to simplify and lessen the work of irrigation, and is therefore recommended as suitable for most parts of this country. The borders and furrows are of course intended to remain as permanent features of the land and should be regularly maintained in good repair.

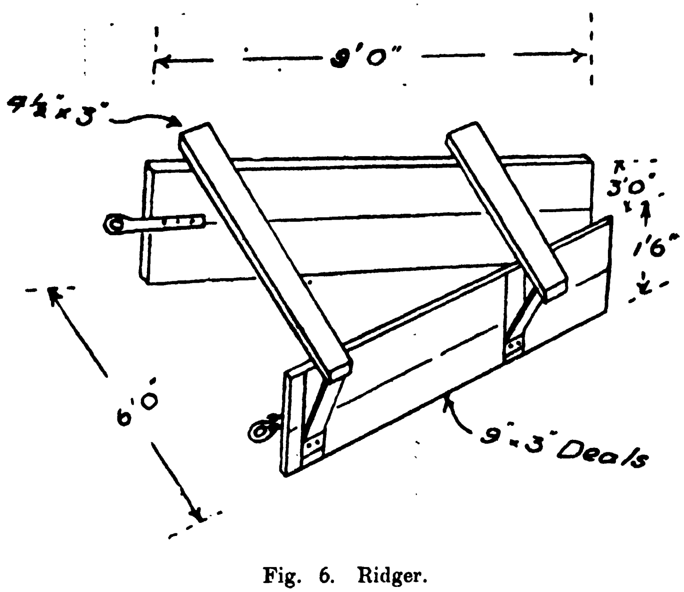

Fig. 6. Ridger.

Flooding in Basins and Checks.—This method has a very limited application in this country, as it is chiefly suitable where the ground is very flat. It is largely used by the small irrigators in countries such as Egypt, India and China for the production of rice and other cereals. The objection to it is that unless the soil is very retentive and the inlet to the basin has a large discharge, the part of the basin nearest to the inlet will suffer owing to receiving an excess of water. The system, however, possesses the advantages of simplifying irrigation and reducing supervision.

A field laid out on this system is shown in fig. 7, where the basins are divided by low banks and each is flooded in turn by closing the outlet and blocking the central channel. The size and shape of basins are largely influenced by the slope of the land and supply of water available. Generally speaking, however, they should be as small as is compatible with reasonable ease of working implements, in order to

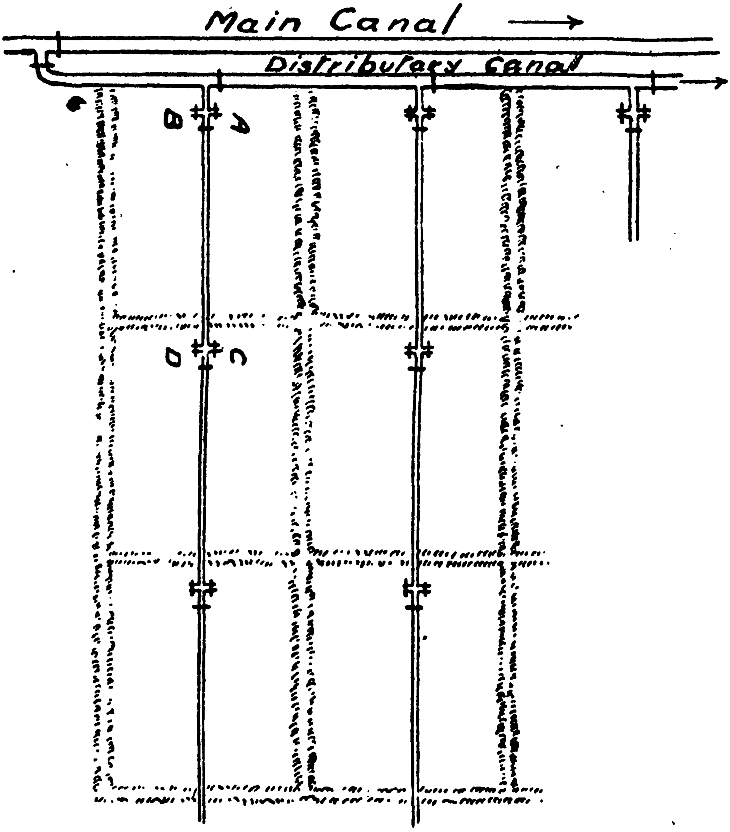

Fig. 7. Basin system of Irrigation.

secure economy and uniformity of irrigation and to lessen the height of the banks. For the growing of onions and similar small crops, the basins may be only a few yards in extent.

The basin method is well suited for the irrigation of semi-permanent crops, such as lucerne, but has lost in popularity to the "border" method. A modification of the

basin method is used in many citrus groves, and is described in Bulletin No. 669, "Citrus Fruit Growing in Rhodesia," of January, 1928, by G. W. Marshall, Horticulturist.

B. Furrow System.—Irrigation by Furrows.—This method is naturally adopted for the irrigation of crops grown in rows, although it can also be applied to others. It is often the only feasible system on steep slopes, where extensive terracing is not justifiable for reasons of economy. The water is turned from the distributary into smaller furrows which run across the field upon a regular grade, which is insufficient to cause erosion.

The nature of the soil directly determines the depth, the spacing, the length and the gradient of the furrows, so that no general rule can be laid down; but as a guide it may be taken that for average conditions the furrows should be on a gradient of 1 in 200, may be spaced 3 feet apart and should be limited to 400 feet in length. In growing shallow-rooted crops or in irrigating a shallow soil the furrows should likewise be shallow, but it should be remembered in general that the top layer of dry soil mulch should not be wetted, and relatively deep furrows will help to prevent this. For compact soils and for steep slopes the furrows should be closer together, in order to ensure all the ground between the furrows becoming thoroughly wetted, and the length and size of furrows may be increased, and the gradient flattened. The reverse is the case with porous absorbent soils. The water is allowed to run in each furrow until it reaches the lower end before the supply is shut off and turned into the next furrow.

Alternatively a large number of furrows are allowed to run at the same time, each being supplied with a small but definite quantity of water for a considerable time. In any case, it is advisable to feed the furrows by small pipes or holes in the side of a permanent brick distributary.

The advantages of furrow irrigation include not only that of suitability for steep and undulating country, but also because it secures a thorough wetting of the root systems of the crops, thus tending to promote deep rooting and to prevent baking of the surface. After irrigation it is practicable to get over the ground sooner with a cultivator, which is very desirable, as thereby evaporation is reduced.

The furrows should be laid out with the use of a dumpy level, and it should be sufficient to mark out, say, every tenth furrow and put in the intermediate ones parallel.

Furrow irrigation is commonly used for citrus groves, and this aspect is fully dealt with in the Bulletin No. 669 above mentioned.

Corrugation System.—This is a combination of the two general systems of flooding and furrow irrigation, and is frequently used for watering uncultivated crops such as small grain and hay. The corrugations are formed by drawing a light sledge, fitted with two or more runners, over the prepared and planted surface of the land. The most usual spacing and length of the corrugations is 16 inches apart and 300 feet long, but these dimensions are affected in the same way as described above in the case of furrow irrigation. The size should be such that the stream is just carried without over-flowing, and under average conditions may be 3 or 4 inches deep and 5 or 6 inches wide.

The corrugation method is well adapted to steep and undulating land; for flat land it is preferable to use the border system.

In both the furrow and corrugation systems the proper spacing may be determined for any given soil by the simple expedient of running water for different lengths of time through separate corrugations, and then digging a trench across to determine the area of dampened soil.

Volume of Water.—While it cannot be too strongly emphasised that the stream of water operated by each individual irrigator should be strictly limited to what he can efficiently control, the other side of the question is almost equally important. It is, unfortunately, common to see attempts to divert and lead a small trickle of water, which can only result in wastage in at least two ways:—

(a) excessive seepage losses in canals which are often a mile or more in length;

(b) evaporation losses in the lands.

There is a certain flow of water, known as a "leading stream," the size of which is difficult of accurate definition, but which is conveniently and economically controlled in the field, and is well known to practised irrigators. Assuming

that the "leading stream" is about ½ cusec, then, for example, for three irrigators the main canal should deliver at least 1½ cusecs.

The point to be observed, therefore, is that if it is impossible to divert continuously a sufficient flow of water, then provision must be made to store up water and release it at given times in the required volume. This storage may be provided either at the source of supply (*i.e.*, by raising the level of the weir or dam) or near the lands (*e.g.*, in scooped out earth reservoirs or brick tanks). In the case of large storage dams, of course, all that is necessary is to release the water in sufficient quantity for a given period.

As a corollary to the above, it is important to divide the irrigable area into blocks, each capable of being uniformly irrigated in a short time.

In porous soil it is advisable to line the permanent furrows so as to minimise loss by seepage on the way. This will also tend to prevent water-logging.

These precautions should result in a prevention of waste of both water and labour, and should enable a larger acreage to be irrigated with the same supply of both. It is almost always of advantage to arrange for definite periods of irrigation, so that when labour is not required for watering it may be used for other farm work, if a little care is taken with organisation.

Protection against Storm-Water.—Irrigated land is naturally more valuable than general arable land, and it is therefore of even greater importance that adequate protection should be given against damage by storm-water, either through water-logging or erosion.

In large schemes the main canal itself may be capable of dealing with storm-water, and it is only necessary to provide sufficient discharge clear of the lands, but in many of the small furrows found in minor individual schemes in Rhodesia it is necessary to provide storm-water drains above them. These drains will usually be considerably bigger and on a steeper gradient (say, 1 in 250). Distributary furrows and others which run down the steep slope should be protected against erosion by lining or the building of masonry "drops."

In the land itself it is also necessary to provide against the accumulation of water in dangerous volumes. In this way the border system is particularly valuable. Furrow systems should be carefully watched to prevent the water breaking over from one channel to the next and commencing a wash-out.

Drainage of Irrigated Lands.—The necessity for drainage can to a large extent be avoided by the skilful and not excessive use of water and by keeping open the natural drainage channels. In spite of this, however, some areas will suffer seriously if no drainage is artificially provided, since plant roots require air as much as water, and standing sub-soil water excludes air. If any doubt is felt, it is advisable to open small wells at different parts of the land and observe the level of the underground water. It is always cheaper to put in the drains while the ground water is still at a reasonable depth, than to wait for the appearance of wet patches, which may cause the partial loss of a crop.

Open drains will do the work, but covered drains of stone, timber or preferably tile are more efficient and economical in the long run. It is generally accepted that the depth of a drain in irrigated lands should, if possible, not be less than 6 feet.

The position of drains depends largely upon the source of the damaging water, and generally it is advisable to obtain expert advice in laying out the drainage lines. Occasionally it happens that water is percolating from above, and then reclamation can often be effected by cutting drains at the head of the land to intercept the seepage. In other cases the drains will be placed in low parts and lines of depression in order to facilitate the natural drainage tendency.

"Brak."—Some soils contain an exceptionally high percentage of alkaline salts, which is especially the case in areas which have at some time been subject to very low rainfall. Under these arid conditions the rainfall is insufficient to perform its natural function of leaching away the soluble salts, which therefore accumulate in harmful quantities in the soil and sub-soil. When irrigation water is applied the salts are drawn to the surface by capillary action following on evaporation, particularly when the underground water level is high.

The best methods of preventing excessive alkalinity lie in the use of proper systems of irrigation, the growing of resistant crops and, if possible, the use of a chemically corrective irrigation water. The commonest curative measure employed is that of "leaching" away the injurious salts by the application of a heavy watering. The first essential of this process is the provision of adequate deep drainage, which lowers the water table and discharges water descending from the surface containing the dissolved salts. If proper drainage is installed sufficiently early, it will act as a preventive measure.

Evaporation from Soils.—Evaporation plays a very important part in irrigation, and affects, and is affected by, the condition of the soil. Unlike evaporation from a free water surface, evaporation from soil is governed not so much by temperature, wind and humidity as by the percentage moisture content of the top layer of soil. This points the moral of the wisdom of maintaining a good surface mulch by cultivation (as soon as practicable after irrigation), which breaks up the "capillary tubes" through which evaporation takes place. Also by experiment it has been found that with furrows 9 inches deep the evaporation loss is only half that lost after irrigation by flooding.

In cases where water is cheap the loss by evaporation may not be of great moment, but with a limited supply of water, so common in Rhodesia, it is of great importance and may seriously restrict the irrigable area and reduce the quantity and quality of the crops.

Evaporation losses may be minimised by the provision of storage to obtain an adequate "leading stream" (as recommended in a preceding paragraph), so that the blocks of land may be watered as rapidly as possible in definite periods of time.

SUMMARY.

1. Have a systematic lay-out, and adapt it to the crops and type of soil.

2. Irrigated land is valuable and should be kept in good heart by regular green manuring.

3. It pays to go to some trouble to prepare and level the land at the outset.

4. Adopt a recommended method of applying water, and work as far as possible to a definite programme, to economise labour and water.

5. Use an adequate "leading stream," and, if necessary, provide storage accommodation to obtain it.

6. Make the "permanent" furrows really permanent, and pay attention to maintenance.

7. Water-logging and "brak" may be avoided by proper methods of irrigation, but do not delay to instal an adequate system of under-drainage if necessary.

8. Cultivation after irrigation (but not too soon after) will reduce evaporation, and prevent caking of the surface.

9. Train your labour to make efficient use of the available water.

REFERENCES.

Acknowledgment is duly made to the following:—

"Use of Water in Irrigation," by Samuel Fortier, D.Sc.

"Irrigation Engineering," by Davis and Wilson.

"The Principles of Irrigation Engineering," by F. E. Kanthack, M.I.C.E.

PIGS FOR SALE.

Pedigree Large Black and Large White boars and gilts —the progeny of pigs recently imported from England—will be available for sale from the Gwebi farm from February onwards. Orders may now be booked. Prices: five guineas for animals of five months of age, and one additional guinea for each additional month of age up to a maximum of seven guineas at seven months old or more. No pedigree pigs will be sold at a younger age than five months. Prices are f.o.r. Gwebi, and crates are returnable at cost of purchaser.

Enquiries in the first instance to be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury.

Establishing Pines.

PRELIMINARY OBSERVATIONS ON THE EFFECTS OF SOIL INOCULATION.

Issued by the Division of Forestry.

Until recently the unsatisfactory growth of pines in certain localities which appeared to be suitable for afforestation was a vexing problem to many tree planters.

In some areas where the growth of other conifers was excellent, pine planting and sowings were so disappointing that it was decided to discontinue them altogether. Before this was done, however, a final effort was made to discover whether the absence of some soil organism was the cause of the excessively slow growth and the feeble, yellow, stunted appearance of many young pines.

Recent experiments in Western Australia had shown that soil taken from an old pine nursery and hoed in on new nursery soils which were giving unsatisfactory plants had the effect of producing in a very short time healthy, vigorous young pines. It was indicated that the success of this experiment was due to the infection of the soil with a species of fungus, which, acting with the roots of the pines, appears to prepare the nutrient solutions in a form readily assimilated by them. A root associated in such a manner with a fungus is known as a "mycorhiza."

On the Imbeza Forest Estate, Penhalonga, plants of *Pinus insignis*, raised from seed in the estate nursery, were set out in February, 1927. The germination of the seed and the growth of the seedlings before pricking out were slow but satisfactory. After pricking out, however, the plants assumed a sickly yellow colour and made little or no growth. The application of liquid manure, bone meal and nitrate of soda achieved no response.

It was hoped that by setting out the transplants in the field on a picked site, some improvement eventually would be noticed. In November, 1930, however, the plants, though

still alive, were not four inches in height. They were obviously unhealthy and were characterised by having short, brittle yellow needles.

Plantings of *Pinus longifolia,* raised at the same time, gave similar results, and transplants of *Pinus insignis,* which were held over in tins in the nursery, were equally disappointing.

In 1928 surface soil was obtained from a thriving plantation of mixed *Pinus insignis* and *Pinus patula* seven years old, growing on the Stapleford Forest Reserve in the Umtali district. This soil was forked into the seed beds at Imbeza to a depth of four inches and seed of *Pinus insignis* was sown.

Germination and growth prior to pricking out were satisfactory. The seedlings were pricked out into beds into which had been raked a light dressing of Stapleford soil. In a short time the transplants began to grow vigorously and had none of the unhealthy appearance characteristic of the 1927 plants. The plants were eventually set out in 1929 side by side with the 1927 plantings, and after nine months their growth averaged thirteen inches in height, as against four inches of the three and a half year old plants.

Soil was also forked in round the 1927 *Pinus longifolia* and the *Pinus insignis,* which had been held over in the nursery. Within a month the plants had assumed a healthy colour and began to grow vigorously.

Other pines such as *Pinus patula, Pinus muricata, Pinus tæda* and *Pinus caribæa* grown in infected soil have responded with equal success, and in all cases the roots show the presence of a fungus.

On the deep Kalahari sand of the Mtao Forest Reserve the establishment of *Pinus insignis* prior to the season 1929-30 had been far from satisfactory.

Infected pine soil was accordingly introduced from Stapleford and forked into tins containing *Pinus insignis* transplants which had an unthrifty appearance. Three weeks after the application the young needles began to assume a very healthy, bright green colour. Early in March, 1930, the inoculated trees were planted out and now form the best stand of pines ever established on the reserve.

In preparing nursery soil for transplants to be used during the present season a thorough mixture with infected soil was obtained. The soil was then watered and allowed

to lie for two months. The resulting trees pricked out into this soil far outshone in health and vigour even those of the previous season. It is further interesting to note that for the first time no "damping off" was experienced among the young pines. This may or may not be due to the fungus.

On the Stapleford Forest Reserve itself it is not known how the mycorhiza became established in the thriving stand of *Pinus insignis* and *Pinus patula*. At the time the trees were planted the property was in private hands. It is known that the *Pinus patula* was raised from seed sown on the property.

It is very probable, as Kessell, of Western Australia, suggests, that spores of the fungus are introduced with the seed. This probability is borne out by observation at Stapleford. It was observed that eighteen months after *in situ* sowing in the same compartment of *Pinus insignis*, *Pinus pinaster* and *Cupressus lusitanica* only one *Pinus insignis* plant per acre in a 40 per cent. stand had a normal appearance.

The success of these preliminary tests indicated that where conditions in this Colony are favourable for pine growth, only inoculated stock should be planted. To make assurance doubly sure both seed-beds and transplant-beds should be given an application of infected soil. A handful to the square foot should be forked or raked into the beds. In carrying out *in situ* sowings about a tea-spoonful of infected soil is given to each spot.

It would appear that where pines are thriving the fungus must be present, and that to obtain infected soil, it suffices to scrape the surface in a plantation or near a healthy tree. The fungus in this Colony has not yet been determined. That it serves the required purpose for many pines is shown by the healthy transplants which have been obtained from *Pinus insignis*, *Pinus patula*, *Pinus tæda*, *Pinus canariensis*, *Pinus longifolia*, *Pinus mitis*, *Pinus caribæa*, *Pinus densiflora*, *Pinus pinaster*, *Pinus muricata*, *Pinus laricio* variety *austriaca* and *Pinus banksiana*.

Acknowledgments are due to the forest officer of the Imbeza Forest Estate and to the forester in charge of the Mtao Fairfield Patrol for the information given in this article concerning their respective stations.

Gwelo Municipal Demonstration Station.

ANNUAL REPORT, 1929-30.

By S. D. Timson, M.C., Inter. B.Sc. (Agric.) Lond., Dip. Agric. (Wye), Assistant Agriculturist.

This station is conducted in co-operation between the Municipality of Gwelo and the Department of Agriculture. Since its inauguration in 1924-25 the work has been supervised by Mr. W. Hopkins, of the municipal staff, to whom the greatest credit is due for the careful manner in which all operations have been carried out and recorded.

The season under review was far from favourable, for the total effective rainfall, that is the fall during the months of November to March, was only 18.42 inches. Furthermore, there were two considerable periods of complete drought, each lasting 25 days, the first occurring from the 22nd December onwards, and the second from the 25th January onwards. Between these two droughts only 1.74 inches of rain fell in the nine days' interval.

In consequence of these droughts, the yields of maize on the station were very much lower than those obtained during the favourable season of 1928-29. In the latter year, the four maize plots in the two rotation trials yielded an average of 21.2 bags per acre, whilst for 1929-30 the average yield of the same plots was only 7.04 bags per acre, almost exactly one-third of the yield in the previous year.

The following tables show the incidence of the rainfall during the season. There is no rain gauge at the red soil station, which is approximately a mile from the Gwelo gaol and about the same distance from the sand veld station. The rainfall figures quoted above are taken from the sand veld station record, of which the total annual rainfall was two inches in excess of that of the gaol.

GWELO GAOL RECORDS.

Month	Fall.	Total No. of days on which rain fell.	Greatest fall in one day.	Average for last 7 years, 1923-24 to 1929-30.	Average for last 30 years.
July	...	...	...	.03	.02
August	.07	2	.04	.01	.08
September	...	...	...	.18	.17
October	.03	1	.03	.74	.74
November	6.39	15	1.75	3.02	3.66
December	6.81	14	1.91	6.99	6.00
January	1.39	6	.82	4.75	5.98
February	1.66	5	1.03	4.89	5.33
March	1.63	9	.45	3.55	3.34
April	3.31	11	1.06	1.10	.71
May	.06	1	.06	.14	.32
June	...	...	...	.01	.02
Total	21.35	54	1.91	25.41	26.37
Mean	1.78	4.50		2.12	2.18

GWELO EXPERIMENT STATION (SAND VELD).

Month.	Fall.	Total days.	Greatest fall.	Average for 5 years, 1925-26 to 1929-30
July	...	...	...	...
August	...	...	...	...
September	...	...	...	.31
October	...	...	...	.63
November	5.95	11	1.45	2.99
December	6.43	13	1.80	5.71
January	1.74	7	.90	4.86
February	2.49	4	1.19	4.33
March	1.81	11	.40	3.20
April	4.79	9	2.42	1.17
May	...	...	...	...
June	.18	3	.09	.04
Total	23.39	58	2.42	23.24
Mean	1.95	4.83		1.94

Despite the very unfavourable season it will be seen that the average yield of the four plots in the rotation which were under maize was 7.0 bags per acre, and in view of all the circumstances this can be considered satisfactory. The highest yield of any plot was 8.13 bags per acre. Of the plots which have grown maize continuously, that which receives no fertiliser or manure yielded 4.2 bags per acre. This yield would probably have been lower had the plot not received in error an application of fertiliser in 1927-28. The continuous maize plot which receives fertiliser every third year, and which received the last application the previous year (1928-29), yielded 5.6 bags per acre.

In connection with the yields from the continuous maize plots in 1928-29, it is interesting to note how soil which has been reduced to a low level of fertility by continuously growing the one crop will temporarily give satisfactory yields in a season when the rainfall is particularly good, both in respect of quantity and distribution. This has also been very well exemplified on the Salisbury Experiment Station. It is this temporary recovery in favourable seasons which has, to a considerable degree, been responsible for many farmers failing to realise the extent to which their land has been impoverished.

A very interesting and important point, evidence in support of which is to be found in the results of the two rotation trials, is that the ploughing under of a green manure crop once in four years, and the application of phosphatic fertiliser to the land twice in the four years, appears to be equivalent in maintaining fertility to an application of seven to eight tons of farm manure per acre and one application of fertiliser in the four-year period. This again is supported by the rotation trials carried out at Bulawayo Municipal Station, over a period of seven years, where almost identical results have been obtained.

On the Gwelo station the average yield of maize in Rotation Series A (green manure) over the six-year period is 13.0 bags per acre, and in Rotation Series B (farm manure) the average yield of maize is 13.1 bags per acre for the same period.

If the low average annual rainfall during the six-year period of the existence of these rotation trials be considered, it is abundantly evident that these two systems of rotation have maintained the soil fertility at a high level, since the average yield per acre of the land under maize in both rotations is 13.0 bags per acre, and the average yield of ground nuts for five years out of the six is 18.0 bags per acre.

Although these rotations will not suit all systems of farming, yet they can be amended to conform with the requirements of any individual farm. The rate of application of fertiliser and manure should not, however, be reduced, as these may be looked upon as minimum quantities.

Farmers are again reminded that the services of officers of the Division of Plant Industry are available to assist them in designing suitable cropping programmes for their own particular needs.

RED SOIL STATION—ROTATION EXPERIMENTS.

Rotation Series A.

Plots of ½ acre each.

Yields of Maize in Bags of 200 lbs. each per Acre.

Crop.	1929 30 rainfall 23.39 in.	1928-29 rainfall 34.07 in.	1927-28 rainfall 19.64 in.	1926-27 rainfall 19.28 ins.	1925-26 rainfall 19.53 in.	1924-25 rainfall 47.21 in.	Average yield per acre, 6 years.
Velvet Beans—* Ploughed under.	...	...	...	..	...	...	...
Maize— Receives 200 lbs. per acre bone and superphosphate—after velvet beans ploughed under.	7.2	21.1	9.2	13.0	21.0	14.5	14.35
Maize— Receives no fertiliser—after maize receiving fertiliser.	6.9	18.9	8 0	12.0	12.0	13.0	11.80
Ground Nuts— Receive 200 lbs. per acre superphosphate—after maize receiving no fertiliser.	13.6	21.6	13.2	19 0	23.0	Sudan grass.	18.08
		Yields of	ground nuts	in bags of 75	lbs. each per	acre.	

* *Note.*—Commencing 1930-31, Sunn hemp replaces velvet beans.

Rotation Series B.

Crop.	1929-30	1928-29	1927-28	1926-27	1925-26	1924-25	Average yield per acre 6 years.
Velvet Beans— Reaped.	2.9	2.3	3.2	3.0	...	4.25	3.14 (5 years)
Maize— Receives 200 lbs. superphosphate per acre—after beans reaped.	5.9	21.2	9.9	9.0	10.0	9.5	10.91
Maize— Receives 7 to 8 tons farm manure per acre—after maize plus fertiliser.	8.1	23.7	11.3	16.0	14.0	19.0	15.36
Oats (Kherson)— After maize plus farm manure.	900 lbs.	604 lbs.	Fed green.	Fed green.	Fed green.	Fed green.	752 lbs. (2 years)

Maize Continuous.

Crop.	1929-30	1928-29	1927-28	1926-27	1925-26	1924-25	Average.
A— Maize continuous without treatment.	4.2	13.1	4.4* fertiliser applied in error.	4.0	6.0	9.0	6.79
B— Maize continuous—receives 150 lbs. per acre bone and superphosphate every third year.	5.6	15.3 fertiliser applied.	7.6	6.0	12.0	12.0 fertiliser applied.	9.75

*In 1927-28 fertiliser was applied to this plot by error instead of to plot B, which should have received fertiliser every third year, and now will receive fertiliser every alternate year, commencing 1930 31.

Legumes for Grain.

Crop.	1929-30 Yield per acre in lbs.	Average yield per acre in lbs. to date.
Velvet Beans—		
White Stingless	461 (3 plots)	661 (5 years)
Tracey's Early Black	...	800 (1 year)
Osceola	...	660 (1 year)
Dolichos Beans—		
Brown small seeded ...	604	697 (4 years)
Cowpeas or kaffir beans	468	501 (5 years)
Soya beans	...	378 (1 year)
Gram	...	1,304 (1 year)
Canadian wedge pea ...	...	472 (1 year)
Sunn hemp	388	388 (1 year)

Notes on the above crops, with the exception of Sunn hemp, were included in the annual report for 1928-29, but they may be amplified here in one or two particulars.

Soya Beans.—The growing of this crop cannot be recommended unless the soil contains an adequate supply of humus and the seed or soil is inoculated with the proper bacteria. All Rhodesian soils do not appear to contain the specific soya bean bacteria, which are not known to live in union with any other type of legume, and to obtain the best growth of this crop it may be necessary to introduce them either by inoculating the seed with the proper culture, or by inoculation of the land with soil containing the bacteria. Cultures for the inoculation of the seed are obtainable now in South Africa, and once a portion of the land has grown a crop from successfully inoculated seed, the soil can be utilised for further inoculation.

Sunn Hemp is the best green manuring crop grown in Rhodesia, when all its qualities are considered, with the possible exception that on the poorer sandy soils the kaffir bean or cowpea may be more suitable. In future it will replace velvet beans as the green manure crop in Rotation Series A.

At present Sunn hemp is often sown too thinly to allow it to exercise properly its wonderful weed-smothering powers. For green manuring it should be sown at the rate of *at least* 35 lbs. of seed per acre. If the sample of seed is poor, the

seeding rate must be increased up to 50 or even 60 lbs. per acre. When grown for seed, it should be sown thinly at a rate of about 15 to 20 lbs. per acre.

Ground Nuts.

Yields in Bags of 75 lbs. (unshelled) Nuts.

1929-30.	Average to date in rotation A.	Average to date not grown in rotation.	Average of 9 plots in 6 years.
13.6	17.3	16.7	16.9

The highest yield obtained was 23.0 bags per acre in 1925-26 in Rotation A.

Ground nuts are a valuable stock feed for use on the farm, and there is also a good market in Great Britain for selected nuts in unstained shells. The red and chocolate soils of this country stain the shells, but sandy soils will grow excellent crops with clean white shells. On these sandy soils the ground nut may well be one of the most profitable crops that can be grown for export overseas. The soil, however, must contain an ample supply of humus and phosphatic plant food. Ground nuts yield their best returns where they are grown in a suitable rotation with other crops in which the humus supply is maintained by green manuring, or the addition of farm manure to a previous crop.

Miscellaneous Crops.

	1939-30. Bags.	Average yield per acre to date. Bags.
Sunflowers—		
Large Black Russian	6.0	7.2 (5 years)
Small Black Russian	...	7.0 (1 year)
Kaffir corn	...	353 lbs. (3 years)
Linseed—		
White flowered	...	289 lbs. (3 years)
Boer manna	...	794 lbs. (2 years)
Oats—		
Kherson	900 lbs.	752 lbs. (3 years)

SAND VELD STATION.

The crops on this station always suffer more from an unfavourable season than those on the red soil station, as the soil is poor, shallow and of uneven quality, and the drainage is very defective. The average sand soils of this country under cultivation are superior in fertility and drainage, and considerably higher yields should be obtainable on them than those recorded on this station if proper methods of farming are employed.

The chief problem on our sandy soils in this country is the maintenance of an adequate supply of humus. In addition, these soils are generally more deficient in phosphatic and other plant foods than the red soils. But, if such land is naturally well drained, and if proper steps are taken to maintain fertility, they are capable of producing excellent yields of most of the staple crops.

In both the four course rotations demonstrated on this station, half the land each year is under maize, a quarter under ground nuts and a quarter under oats. In Rotation No. 1 the land receives 200 lbs. per acre of bone and superphosphate and six tons farm manure per acre every four years, the former being applied to the maize following the ground nut crop, which receives the farm manure.

In Rotation No. 2 the ground nut crop receives a dressing of 200 lbs. per acre of superphosphate, and the maize receives the farm manure.

Commencing in 1929-30 the maize receiving fertiliser in Rotation No. 1 is underplanted at the last cultivation with cowpeas, and the maize without treatment is underplanted with velvet beans. In Rotation No. 2 only the maize following ground nuts is underplanted with cowpeas.

During the season under review, all the plots in Rotation No. 1 received a dressing of six tons farm manure per acre.

Rotation Series No. 1.

Yields in Bags per Acre.

Crop.	1929-30	1928-29	1927-28	1926-27	Average yield.
Maize— Receives 200 lbs. bone and superphosphate per acre—following ground nuts.	3.6	4.6	6.5	15.0	7.4
Maize— No treatment—following maize receiving fertiliser.	4.0	5.1	5.6	11.0	6.4
Oats— Following maize.	312 lbs.	580 lbs.	...	...	446 lbs.
Ground Nuts— Receive 6 tons farm manure per acre—following oats.	10.5	7.0	10.8	20.0	12.0

In 1926-27 all plots received a dressing of six tons per acre of farm manure. In 1927-28 the maize after maize plus fertiliser received six tons of farm manure per acre, and in 1929-30 all plots again received six tons of farm manure per acre.

Rotation Series No. 2.

Yield in Bags per Acre.

Crop.	1929-30	1928-29	1927-28	1926-27	Average yield.
Maize— No treatment—following ground nuts plus fertiliser.	6.3	3.8	3.2	10.5	5.96
Maize— Receives 6 tons farm manure per acre—following maize without treatment.	4.0	4.8	6.9	13.5	7.31
Oats (Kinvarra)— No treatment—following maize receiving farm manure.	failed owing to drought.	372 lbs.	...	...	372 lbs.
Ground Nuts— Receive 200 lbs. per acre of superphosphate.	15.2	7.6	9.3	16.0	12.0

Commencing in 1929-30 the maize following ground nuts is underplanted with cowpeas in January at the last cultivation of the maize.

Ground Nuts.

Yields per Acre in Bags of 75 lbs. each (unshelled nuts).

	Rain-fall 23.4 in. 1929-30	Rain-fall 34.07 in. 1928-29	Rain-fall 19.64 in. 1927-28	Rain-fall 19.28 in. 1926-27	Rain-fall 19.53 in. 1925-26	Rain-fall 47.21 in. 1924-25	Averag yield pe acre ove 6 seasor
Average yield of all plots on station	12.8	15.3	10.0	17.3	11.0	10.8	12.8 bags

It will be seen from the above table that ground nuts are one of the most dependable and highest yielding crops on poor sandy soils such as exist on this station. The average yield per acre over the six-year period is 12.8 bags of nuts per acre.

Where mixed farming is practised, the whole plant—nuts and vine—can be ground up in meal for stock feed, or the vines can be converted into hay and the nuts sent to the oil factory to be exchanged for cake.

Seeds for Sale, Gwebi Farm.

		s.	d.
Majorda Seed	at per lb.	1	1
Sunflower Seed (Large Black)	at per 100 lbs.	16	0
Sunflower Seed (Small Black)	at per 100 lbs.	16	0
Sweet Potato Slips (Calabash Leaf), available December and January	at per bag	6	0
Napier Fodder Roots	at per bag	6	0
Edible Canna Tubers	at per 100 tubers	9	0
Dolichos Beans	at per 100 lbs.	21	0

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

Mr. W. R. Blackwell's herd of Frieslands, Daisy Farm, Norton.

A good milking performance. De Grendel Boukje, No. 2345, Vol. III. Date of birth 12.6.21. Calved 8.10.29. Property of Col. A. F. Valentine, Battery Spruit, Umtali. This cow, in an official test over 300 days, produced 8,085.50 lbs. milk, yielding 306.8 lbs. butter fat, this being equivalent to 356 lbs. of commercial butter.

Morgenzon Kleingoed, during first 30-day period of present lactation, gave over 1,600 lbs. milk, with a butter-fat test of 4.10 per cent. The property of Mr. W. R. Blackwell, Daisy Farm, Norton.

The Advantages of Balanced Rations and Milk Recording.

By W. R. Blackwell, Daisy Farm, Norton.

As an owner of dairy cattle which are officially milk-recorded, my experiences of the benefits derived thereby may be of interest to those considering whether they should support the scheme or not.

The milking herd consists of pure-bred and pedigree Frieslands.

In August, 1929, I was persuaded, with a certain amount of dubiousness on my part, to have my herd officially milk-recorded, but did not pay due regard to feeding of *balanced* rations, with the result that my feeding costs were higher than they should have been and the milk yield not satisfactory. In August of this year, on the advice of the official milk recorder, and with his assistance, a balanced ration was made up, to consist of as little bought feed as possible.

The foodstuffs available on the farm consisted of maize meal and a dump of sunflower husks and chaff, two pits of silage and a large quantity of majordas. The only food bought was ground nut cake.

The following was the ration drawn up:—

		Lbs.	
Concentrates	Maize meal	2.00	for every one gallon of milk.
	Ground nut cake	0.75	
	Sunflower seed	0.50	
	Sunflower head	2.00	

(Sunflower head up to palatable amount only.)

Sliced majordas were fed to cows at the rate of 30 pounds per head per day. Previous to this, ground nut cake, bran, beans and crushed sunflower seed had been used.

The following table illustrates the remarkable increase in the milk yield of five cows since the balanced ration was fed during the period September to December. Cows are practically in same period of their lactation as the previous year:—

Name of cow.	Yield, Sept.-Dec., 1929. Unbalanced ration. Lbs. of milk.	Yield, Sept.-Dec., 1930. Balanced ration. Lbs. of milk.	Total increase in yield. Lbs. of milk.	Per cent. increase. Milk.
Kleinbloem	2,902.0	4,840.7	1,938.7	66.8
Ermine	2,025.1	4,886.4	2,861.3	141.3
Kleinhans	2,301.3	4,199.4	1,898.1	82.5
Primrose	2,374.9	4,141.8	1,766.9	74.4
Waterbloem	2,059.5	4,112.5	2,053.0	99.7

Other cows have shown the same increase in their milk yields, but these five should suffice.

Cow Morgenzon Kleingold calved recently and has yielded up to 60 pounds milk in 24 hours, whereas in her previous lactation her maximum yield was 32 pounds per day.

Owing to proper feeding, the cows have kept in wonderful condition throughout the winter, and there have been no difficulties in calving, even with heifers. In addition to the concentrates mentioned, a fairly large crop of majordas is grown and maize silage has always been made. It is not the writer's intention, however, to make any silage in future, as the cows prefer majordas. In fact, when ensilage was placed before them, it was left untouched and the milk yield dropped. Feeding of majordas had to be reverted to, when the yield returned to normal. By this I do not wish to infer generally that majordas are preferable to ensilage. No hay was fed, cows grazing during the day. A fair acreage of sweet potatoes is being grown this season; also pumpkins will be grown as well as majordas.

The cost of the balanced ration is calculated at £5 8s. 6d. per ton, based on the market prices for food used. Ground nut cake, £9 per ton; maize meal at 8s. per bag; sunflower seeds at 4s. per bag.

During the four months September to December, twelve cows in milk and to calve have been fed. The quantity of concentrates fed per day has been 108.8 pounds, costing 6s. 3.6d., and the average yield 33.5 gallons per day. This works out at 3.28 pounds of concentrates per gallon of milk.

The cost of majordas has not been considered, as it is not my intention to enter into the matter of costs of production, but merely to show that a balanced ration of concentrates can be fed at little cost, but with a great return by way of increased quantities of milk.

Since December two of the above cows have calved and the milk yield has increased to over 40 gallons per day without extra cost in feeding.

I consider the official milk recording scheme one of the most useful methods supported by the Government for the betterment of the dairy industry. The charge is small, as it probably does not cover the cost of materials used, let alone the travelling expenses of the recorder, and the advantages are many, amongst which can be reckoned:—

(i.) A profitable herd can be built up more quickly because only heifers from the best producing cows must be kept.

(ii.) Increased production at lower costs.

(iii.) Better sale for young bulls and heifers if dams have been officially recorded.

(iv.) Detection of illness, as a sudden drop in milk yield indicates that something is wrong with the cow.

The Training of Pointers and Setters.

(Continued.)

By Duncan K. Smith.

RETRIEVING.

Many sportsmen are of opinion that retrieving is not necessary or desirable in trained pointers or setters and consider that part of the work should be left to a regular retriever. The writer has found that a trained pointer or setter which will retrieve has a great advantage over dogs which will not. Many birds are lost in the long grass, reeds and rough country and along rivers which would be recovered if all dogs were taught to retrieve.

At our local field trials retrieving is looked upon as an advantage, although this is not the case at all South African field trials.

The time expended in perfecting a pointer or setter in retrieving is well repaid, and should a dog show any inclination to answer to training, make a special effort to get him to retrieve. It will probably save many an uncomfortable and wet half hour. Should the dog show no interest in his first few lessons in retrieving, it will probably prove a rather tedious part of his training and should be abandoned unless the handler has had considerable experience.

The alternative to retrieving is "pointing dead," which means that when the dog has located the fallen, dead or wounded bird, he "points" it and remains staunch on point until the bird is picked up by the shooter.

The first thing necessary with a young puppy is to get him interested in the object which is to be retrieved. A pad of flannel or other soft material, if vigorously shaken about in front of the puppy and then thrown a yard or two along the ground, will usually arouse enough interest to make the

"ON REDWING."

"C. H. Redwood Flo" and opponent at Gwelo Field Trials, 1930.

Mr. R. de Vere Cornwell's English setter dog "Greenwood Boss."

pup wish to investigate. Repeat this several times until the puppy picks up the object to shake it or run off with it, whichever he does. Do not on any account frighten him by shouting, etc. Make him know that he has done right, and follow him *slowly*, calling him gently, until you are able to take the pad quietly from him. Reward him with a tit-bit of cooked meat or other dainty. Should he drop the object soon after he has picked it up, treat him as though he had done right, and gradually he will hold the object for longer periods.

Do not neglect the tit-bits for approved behaviour, as the quickest way to a young puppy's brain is through his "tummy." By degrees it will be found that the puppy will bring the object back to the trainer and in return looks for his reward. Do not be satisfied until the pup retains the article retrieved in his mouth until taken by the trainer. He will be over anxious for rewards at first and perhaps drop the pad in his eagerness, but a little perseverance will check that.

It will often be found that the puppy is inclined to "handle" the pad rather roughly. This can be checked by stitching a handful of hard quill feathers from a fowl criss-cross to the flannel pad, so that the pup will have to exercise more care in picking up the "bird," or get scratched and pricked by the sharp butts of the feathers. A "tender" or "soft" mouth is required in a retriever, and the above is of great assistance in attaining this.

Should the pup be disinclined to "deliver to hand," walk away backwards as soon as the puppy has picked up the object. This often has a very good effect, as, in his anxiety to catch up, he will probably carry the pad and try to pass the handler, when he is gently caught and "made a fuss of."

The next and final stage is to make the puppy drop and remain down, while the object is thrown (by this time a good distance) and until he is given the command to retrieve. The pup may be required to be held down at first. Use the same word of command throughout the retrieving lessons, such as "fetch it" or something similar. A good exercise is when out for a walk, etc., to drop an object and make the dog follow you for some distance and then send him back

to "fetch it." As in other exercises, do not be sparing in your praise for good behaviour.

The size of the object to be retrieved should be gradually increased and of irregular shape, so that the retrieving is made rather more difficult; and it is necessary for the dog to use his head as regards balance, etc., all of which will be of great benefit to him when retrieving game, especially hares and guinea fowl. Do not allow the dog to retrieve hard and very heavy articles, or it will tend to a hard mouth.

In all the above training the object to be retrieved is thrown so that it is in sight of the puppy. Gradually conceal the article as far as possible by throwing it into long grass or cover of some sort, so that the nose rather than the eye will be used in recovering it. Do not keep the lesson going for long enough to tire the puppy, or he will lose interest.

When the puppy is perfect in this and the training as suggested in the previous article, the home training may be said to be complete and the pup is ready to commence the real field training. A dog that is required to "point dead" will have all the necessary home training in the "steady" as detailed in the previous article.

When taking the article retrieved from the dog, always do so gently; do not snatch it away. Should the dog try to retain the object in his mouth instead of releasing it when the trainer wishes to take it, gently press the lips on both sides against the teeth. This will have the effect of making the dog release his hold. Do not press too hard and hurt the dog, as that may frighten him. Always take the object retrieved from the dog in one hand. Do not be tempted to use both hands. As soon as the dog has learned what he is required to do, do not walk away or towards him when he is retrieving; insist on him delivering to hand to where you were standing when the "bird" was thrown.

It is wise to keep the puppy "down" for several seconds after the object has been thrown before commanding him to retrieve. Throughout the training use as few words of command as are necessary. "Steady," "seek," "drop," "fetch it" and "heel" should be all that are wanted, with, of course, the word used for disapproval, such as "tut" or "no" or "wrong."

Nervous dogs are put more at their ease if the eyes of the handler are not directly on them. Do not stare at a dog when he is coming towards you with his "carry." A rabbit or hare skin stuffed with straw will be found useful in the later lessons in retrieving. Do not have out more than one puppy for lessons at the same time. The dog will, of course, have been taught to come in at once to the whistle. Do not neglect this.

In the later retrieving lessons, when the dummy is being found by scent, give a wave of the arm indicating the direction of the "bird." This will be soon understood and will prove of great value later when the real birds have not been "marked down" by the dog. Any little memory training exercises will be of the greatest value later on. Check all errors and mistakes at once. Never excuse "just this once." Bad habits are easily contracted, but hard to eradicate. When your puppy is proficient in all the training dealt with in this and the previous article, he should be ready to take his place in the real thing and be well on his way to becoming a field trial winner.

In taking the "dummy" or bird from a dog which has retrieved, the hand should be held out, palm uppermost, and the bird pressed against the upper jaw before it is released by the dog. This tends to make him hold his "carry" high when delivering to hand. Should a puppy be inclined to bolt with the dummy instead of retrieving to the trainer, a long light but strong cord should be attached to the collar. The trainer will then have control of the puppy while encouraging him to "deliver."

In all the home training, punishment, other than withholding the reward, and a cross word are unnecessary and undesirable. In the following field training it may be necessary to "switch" to enforce discipline, but this should only be reverted to when all other methods have failed. Kindness is in nearly all cases much more readily responded to.

Encourage the puppy to move as fast as possible in carrying out an order, and to "get going" as soon as the order has been given.

The Necessity of Ploughing under Cover Crops Early.

By J. M. MOUBRAY.

Dr. Batchelor, director of the citrus experimental station in California, raises some very interesting and important points as regards the use of legumes as cover crops. He states that a review of the literature on the subject shows that in the majority of experiments the amount of nitrogen fixed is inversely proportional to the amount of available nitrogen in the soil at the time the plants were growing. In other words, the poorer the soil in available nitrogen, the more nitrogen is fixed by the legume, and the richer the soil, the less is fixed.

It is thus seen that the legume crop may not be an important factor in adding nitrogen to the soil in rich and well-fertilised ground. He states that legumes work along the lines of least resistance, and if there is nitrate in the soil they use that instead of taking nitrogen from the air. From determinations of nitrate in the soil on which legumes were growing, he found it low after the crop had reached one half of its growth, and when the crop was mature to the point of turning it under he found the nitrate reduced to almost nothing, which indicated that in its growth the legume cover crop had taken up all the nitrogen from the soil.

This would point to the fact that as far as citrus is concerned, by growing a legume cover crop you completely deprive the trees of all available nitrogen from the ground covered by that cover crop for a certain period. If turned in at the right time most of the nitrogen becomes again available, but here again Dr. Batchelor quotes some very important results which should be studied by all those growing green manure crops in this country, especially where that crop is Sunn hemp.

From this it will be seen that to leave the crop till it gets woody before ploughing it under—as is often done in Rhodesia—is to rob the green manuring process of much of its beneficial action.

Percentage of Total Nitrogen to Produce Nitrates.

Crotolaria Plants.

Age of plants	Percentage of total to nitrify after 2 weeks	after 6 weeks
2 weeks	56.26	78.00
4 weeks	36.73	51.58
6 weeks	24.09	32.12
12 weeks	1.06	13.02

From this I read a most important lesson, and I apply it in the case of tobacco as follows: In order to get the best results as the tobacco plant ripens the supplies of available nitrogen, or, as some authorities denote it, ammonia, should be used up.

If the tobacco plant starts life with an insufficient supply of nitrogen, and about half way through its life is given a liberal supply, which continues till the leaf is harvested, the result is a coarse and heavy leaf difficult to cure. In the case of fire-cured tobacco this abundance of available nitrogen towards the end of the life of the plant, among other results, tends to coarsen the veins in the leaf, lessening its value as a wrapper.

We will assume that a crop of Sunn hemp has been ploughed in after it had reached the woody stage, the year prior to growing a crop of tobacco—quite a common practice when growing fire-cured tobacco. The crop is badly ploughed under and receives little rain afterwards. During the dry season nothing much happens, the woody stalks remaining undecomposed. When the rains come the ground is at once fertilised, hilled up and planted with tobacco.

The soil is now moist, and those organisms whose work it is to break up the carbon compounds which have not become decomposed get to work, but in doing so they require nitrogen, and for the time being they render unavailable the nitrogen that was available for the tobacco plant, robbing it of a most necessary constituent for its growth at a time when most wanted.

As their work is completed and the woody material has become decomposed, the nitrogen that was locked up in an unavailable form again becomes available and the tobacco plant is furnished with a liberal supply of nitrogen just when the supplies in the soil should be diminishing. The result is, as previously stated, to produce a coarse, undesirable type of leaf. The same process applies to the application of unrotted kraal manure.

I would suggest to those tobacco growers who are sufficiently interested and who adopt Sunn hemp as part of their rotation, to leave a strip—quite a narrow one will do—till the Sunn hemp becomes much riper than that already ploughed in. Plough this in as late as possible and observe the results on the tobacco planted on that piece as compared with the rest of the field.

As regards citrus it is most important that the trees should have a good supply of available nitrogen when the fruit is setting, so that it is even more important that there should be no undecomposed vegetable matter in the soil at this time, which would be in the process of being broken up, as the soil would be moist from irrigation; therefore it is essential to plough in the cover crops early—February at the latest.

Empire Surplus of Hides and Skins.

IMPERIAL ECONOMIC COMMITTEE REVIEWS RAW LEATHER TRADE. BETTER QUALITY NEEDED.

The Empire has a surplus of hides and skins, the raw material of leather, over the needs of its own tanning industries in every type of skin except heavy cattle hide, says the 16th Report of the Imperial Economic Committee. ("Hides and Skins"—H.M. Stationery Office, London, W.C. 2. Price 6d. net.)

The leather industry of the United Kingdom takes over £21,000,000 worth of raw material annually, of which about

£6,000,000 worth is obtained from cattle and sheep slaughtered in the country. Of the total imports, about 90 per cent. of the sheep skins, 70 per cent. of the goat skins and 60 per cent. of the hides are of Empire origin.

India, Australia, New Zealand, Canada, the Irish Free State, South Africa and tropical Africa all send substantial quantities of hides and skins to the United Kingdom. Of the heavy hides, more than one-half of the imports from Empire sources come from the Irish Free State. In the case of sheep skins the United Kingdom and the three southern Dominions are, taken together, exporters to the tune of about 30,000,000 skins, most of which go to foreign countries.

Heavy Wastage.—Any future increase in production, the report states, must depend upon the expansion of other industries such as dairying and meat and wool production.

The problem facing the hides and skins industry is one of improving the quality of already available supplies. Wastage of potentially good material is all too common in every producing country.

Ticks.—In Australia, states the report, great damage to the hides is caused by the cattle tick. In Queensland alone ticks do £100,000 worth of damage to hides, and the loss, direct and indirect, to the cattle industry of that State is about ten times this sum. The Commonwealth Government are engaged on active measures to bring the tick evil under control, though "dipping" is the only practical remedy so far discovered.

In South Africa, a Skin and Hide Advisory Board, representing farmers, butchers, tanners, shippers and brokers, has been appointed to advise on the grading up of hides and skins, and a substantial improvement has already been noted by tanners.

Bad Branding.—Another cause of damage is branding. This is often inevitable, but much could be done by restricting branding to one part of the animal, and by persuading ranchers to brand on some less valuable part of the hide, such as the cheek or shoulder, instead of on the best parts, such as the hip.

The most frequent source of trouble is imperfect preparation of the hides at the time of slaughter. The best remedy

for this, when possible, is the concentration of slaughtering at big abattoirs instead of scattered and inexpert slaughtering. In many cases, however, this is a counsel of perfection; but inspectors may prove useful in improving the preparation of skins. This method is giving good results in Nigeria, where a special branch of the veterinary service has been established to inspect and grade skins.

Packing for Selected Ground Nuts.

The General Manager of the Farmers' Co-op. Society, writing on the above subject, states as follows:—

We were in communication with you some time back re the general adoption of the 2½ A twill, second-hand, for export of selected nuts, weight 75 lbs. net, 3 lbs. tare—i.e., the same as the local statutory weight.

Our London office, writing us on the 20th ult., and referring to another consignment, states:—

"We note that you have shipped a further consignment and that these are packed in bags averaging gross approximately 93 lbs. each. The smaller bags meet with quite good reception, and we hope that the Government will adopt this as a regular weight."

From this we gather that our London friends were not at all pleased with the reversion to the use of the barley bags, and wish to impress upon us that they favour the smaller bag, viz., the ordinary 2½-lb.

Reviews.

"The Practice of Soft Cheese-making." Walker Tisdale, Robinson and Woodnutt. Published by George Allen & Unwin, Ltd.

This is a useful manual concerning the practice of soft cheese-making. It gives very good hints as to the production of milk and cream which are applicable to all countries and all conditions. The making of soft cheese of all descriptions is carefully outlined, and would-be cheese-makers will gain a good deal of information therefrom.

Soft cheese-making in Southern Rhodesia, however, is best carried on during the colder months of the year, and it is advised that all who attempt the methods outlined should as far as possible confine their efforts to the period from March to August.

Books on Veterinary and Agricultural Science.

We have been sent by Messrs. Bailliere, Tindall & Cox their catalogue of books on veterinary and agricultural science and animal husbandry dated October, 1930. This is a most useful catalogue, as not only does it contain a complete list of veterinary and agricultural books, but it enables one to see what books are issued on other subjects. In order that its scope and intention may be appreciated, we reprint the following from the publishers' notes introducing the catalogue:—

"This catalogue is divided into the following sections:

Section I. Pages 1-16. Veterinary Science, which contains those books of direct interest to the veterinarian.

Section II. Pages 17-24. Animal Husbandry, which comprises books dealing with such subjects as breeding and management (including small

animals, poultry, bee-keeping, etc.), and also books of interest to some extent to the veterinarian.

Section III. Pages 25-40. Agriculture, which contains those books of particular interest to the scientific agriculturist and to the research worker.

Section IV. Pages 41-45. Atlases, Diagrams and Charts prepared for the veterinary and agricultural students, for those whose work takes them among animals and in the case of the atlas of the ox for students of meat inspection and those studying in the classes arranged for butchers' assistants.

Section V. Pages 46-48. Periodicals, which is divided up into veterinary and agriculture and miscellaneous.

It is inevitable that there must be some overlapping between the various sections, but it is hoped that by publishing the above classes of books in one catalogue an opportunity may be afforded the reader of checking over the books available to him on subjects to which at some time he may desire to refer."

This catalogue is, we are informed, unique, and is certainly one which every member of the veterinary and agricultural profession should have in his possession. Messrs. Bailliere, Tindall & Cox will be glad to send on request copies to anyone who has not already received one.

Farming Calendar.

February.

BEE-KEEPING.

In most parts of the two Rhodesias this month is one of fair activity for all bees, there being as a rule quite enough nectar, pollen, etc., available for all ordinary purposes of rearing, building cells, etc., and working generally for the due upkeep of the colony for the present as well as for the coming winter. Whether there will be any surplus honey for them to store will depend upon what crops the farmer may have on hand at this time, as the usual flora of the land will not supply it until the regular second flow of the year is due, which should be in March to April, according to the season.

Watch carefully for robbers, though, with well attended hives and due care in handling, there should be little to fear in this direction; strong, well filled hives can always repel robbers, which are only successful with weak colonies, and these no apiarist should ever have under his care. Mark well last month's advice, i.e., to have everything in readiness for dealing with unexpected new swarms that may be required as they may come, for nothing is more disconcerting or annoying than to be unready when the time arrives. This applies especially to any swarms that may come from the apiary, for a few days only of neglect of such a hive may easily lead to the moth taking early possession of the combs, and in practically a few hours destroy fully drawn-out combs that would otherwise be of much value for after working upon. Such combs, as they are available, should at once be packed away in an air- and moth-tight box or tin for after usage.

CITRUS FRUITS.

Newly-planted citrus trees should be kept free of weed growth likely to exclude necessary air and light for their normal and healthy development. Citrus trees planted in February seldom give satisfactory results; late planted trees do not mature their new growths before winter, and they are more susceptible to winter injury or the ravages of disease or insect pests. The early planted cover crops will be fit to plough under by the end of the month. Do not delay this operation for fear of the rains ending abruptly. If this occurs, great difficulties will be experienced when attempting to plough in the green crops. Keep all young shelter belt trees free of weed growth, and loosen the soil round their stems fairly frequently to eliminate possible ant injury. This is one of the best months for budding citrus trees, either in the nursery or grove—trees that are to be top worked to profitable varieties. Late out-of-season fruit that may have set during December-January should be stripped from the trees. This fruit is valueless for export, and if allowed to mature, will affect the main crop setting of fruit.

DECIDUOUS FRUITS.

When sufficiently mature, plough under cover crops. This should be possible towards the end of the month.

Summer pruning should be completed early in the month; little or no advantage will be derived from trees treated when the new wood reaches maturity.

Do not allow fruit to become over-ripe, then expect remunerative prices for it. If it is harvested at the correct stage, then well graded and neatly packed, good prices may be expected for the surplus fruit sold.

This is a good month for budding deciduous fruit trees.

CROPS.

Cultivate, and keep on cultivating as weather permits, to destroy weeds. Continue to look out for stalk borer, and, if infection is discovered, deal with infested plants as advised in January notes. Watch witch weed and continue cultivating and hand pulling it. Plough under witch weed, smother and trap crops. Where practised, maize can be under-planted with sweet potato vines after the last cultivation for the following season's requirements. Potatoes and ground nuts will probably need to be ridged again. Catch crops of quick maturing beans, such as tepary bean, also buckwheat, can still be sown. Keep down all noxious weeds. This work can be undertaken on wet days. Make veld grass hay whenever a few days of fine weather permit. Early mowings provide the best hay. Seed beds of onions for early winter planting can be sown towards the end of the month. Keep potatoes in a cool shed, well ventilated. Pick over any potatoes in storage and remove bad ones. Continue to make as much farm manure as possible. Begin to ride manure and place in heaps handy to the lands to be manured.

DAIRYING.

This is normally the flush season as far as dairy produce is concerned; dairy cattle are usually in good condition and cows of average capacity should be able to subsist and maintain a full flow of milk on veld grazing alone. Calves may be given a few hours' exercise on bright, sunny days; young stock, however, should not be allowed to run and graze with the herd, and are best kept in a cool, airy pen opening on to a small shady paddock, where they can obtain a little exercise.

A good quality of sweet hay and water should always be available for young calves.

Cream deteriorates very rapidly under the conditions which obtain at this time of the year, so that every precaution should be taken to keep the cream as cool as possible pending despatch to the creamery. As there is a greater strain than usual on the separator during the flush months, frequent oiling is necessary, and care should be taken that the machine is mounted on a level foundation. The separator and all other dairy utensils must be cleaned immediately after use. First rinse the utensils with cool or lukewarm water, then wash thoroughly with boiling hot water, washing soda and a scrubbing brush; scald finally with boiling water.

The cheese in the storeroom is apt to develop mould during wet weather. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin or permanganate of potash usually checks the development of mould. During these months care must be taken not to use over-acid milk for cheesemaking, and great care should also be taken of the starter. If this latter shows any signs of gasiness or develops any disagreeable flavour or odour it should be discarded and replaced by a fresh, clean starter. The cheese storeroom must be kept dark and flies excluded.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. Plants in the field found infested with the first

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Summary of the Game Laws of Southern Rhodesia

Palm Tree herd of Friesland cattle (Mr. J. S. Struthers, Sinoia).

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Milk Recording.—It is encouraging to note that in spite of the difficult times we are passing through, the milk recording scheme adopted for the benefit of the dairy farmers of this Colony is still gaining ground. Since the scheme was first initiated in July, 1929, the number of recorded herds has more than doubled, and judging from the volume of enquiries received it seems probable that the present total will be added to considerably within the near future.

As mentioned in previous articles, milk recording offers numerous avenues for the improvement of both pedigree and grade herds, and to illustrate the degree of productivity to which a herd of cows may be bred by careful selection and by systematically recording the milk produced by each animal, reference is made to the Third National Milk Yield Competition held in England recently. In this competition

the first prize of £150 was won by Mr. L. J. Evans, of Tittensor, with an average yield of 1,827 gallons of milk from a herd of 24 Frieslands; thus each cow yielded a little over 6 gallons of milk daily.

Details of the two milking competitions referred to in the last issue of this Journal are now available upon application to the Dairy Officer, Department of Agriculture, Salisbury, and full particulars have been posted to each owner of milk recorded cows in Southern Rhodesia. It is anticipated that these competitions will be a yearly event, and it is hoped that every eligible owner of milk-recorded cows will participate.

Export of Cattle from Southern Rhodesia.—The number of cattle exported from Southern Rhodesia in 1930 totalled 60,871, as compared with 73,615 in 1929. The Imperial Cold Storage Company absorbed 33,305 head in 1929 for their overseas contracts, their requirements in 1930 being met by 21,775 head. Exports of slaughter cattle to the Congo during the past year were slightly in excess of the total for 1929, the figures being 24,093 and 23,956 respectively. There was a material decrease in the number of breeding cattle sent to the Congo in 1930, the total being 3,143 as compared with 7,959 in 1929. Northern Rhodesia took 3,597 head of slaughter cattle from us in 1930 and none in the previous year. Exports to Johannesburg for local slaughter in 1930 were maintained at approximately the same level as in 1929, the figure being 7,466, as compared with 7,214 in 1929. Two shipments of live cattle were sent to England in March and May of last year, comprising 160 head in each consignment. In 1929 two shipments of Rhodesian cattle were sent to the same destination, one of 75 head in April and one of 620 head in May.

The Producers' Direct Supply Co-operative Company, Limited.—This co-operative company, promoted by the farmers of Rhodesia for the orderly distribution of farm produce, has now been duly registered under the Co-operative Companies Act of 1925, and a store has been opened

on a good site in Salisbury for the retailing of fruit, vegetables and flowers. Arrangements have also been made for a house to house visitation in the residential areas of the town by means of a fleet of hand carts, and it is hoped in this way to effect considerable sales.

This endeavour of the primary producer to place well graded produce of good quality before the consumer direct at a reasonable price will be watched with the greatest interest, for it is capable of considerable development and expansion. Success in all concerns such as this depends very largely upon efficient management and intelligent direction, and lack of these essentials has sealed the doom of many a promising movement. The board of directors inspires confidence, and we trust it will not be possible to make any legitimate complaint in the direction indicated. On their part the members must see to it that the store is supplied with a continuity of produce of suitable quality and that the requirements of the consumer are met in every way possible. We trust that an early result of the operations of this company will be an appreciable diminution in the quantity of produce brought in from the south.

Full particulars as to membership and matters concerning the company can be obtained from the Secretary, P.O. Box 1111, Salisbury, or the Horticulturist, Department of Agriculture, Salisbury.

Farmers' Days.—The experience of the last two years has shown that when these gatherings are confined to only one day in the year, their primary object is largely vitiated by reason of the great number of visitors who attend. The Farmers' Days at Gwebi and the Matopo Farm respectively were attended last year by between 400 and 450 persons, and it was found quite impossible for so large a body adequately to inspect the arable operations and live stock or to receive anything approaching complete information regarding the methods followed and results obtained.

The Department, while fully appreciating the support which farmers have given to these functions, feels that greater benefit would accrue to all concerned if the visits were made by smaller parties.

For the present, therefore, it is proposed to discontinue the annual Farmers' Day at these two institutions, and instead to invite farmers' associations and similar bodies to make their individual arrangements for visits of inspection.

The Government farms and experiment stations will usually be found in their most interesting stage during the latter half of March and up to the end of the first week in April. It is suggested that neighbouring farmers' associations might unite to visit the institutions on a date mutually convenient and that parties should be confined to numbers approximating 40 to 60 or less.

Arrangements for these visits should be made, whenever possible, at least a fortnight to three weeks in advance of the date proposed, and communications should be addressed, in the case of the Matopo Farm and School of Agriculture, to the Principal of that institution, and in the case of other Government farms and experiment stations, to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

The above proposal is put forward with the sole object of making the visits of greater direct interest and value to those participating. It is hoped that this will prove to be the case and that the numbers of those visiting the farms will thereby be still further increased.

The date of the annual sale of dairy cattle from the Gwebi Farm will be announced later.

Export of Cattle to England.—Arrangements are now complete for the despatch of the two shipments of cattle to England during the present season. The first consignment of 400 head is due to leave Capetown about 1st April per s.s. Clan Morrison, and the second shipment of 500 head about the end of that month per s.s. Heraclides. Some 1,200 head have been inspected, of which 300 head have been rejected as not being suitable for export. The quality of the animals accepted for export is, on the whole, good, although some of the animals offered by new shippers are somewhat lighter and carry less "beef blood" than is desirable.

Great interest centres around these consignments, and it is anticipated that if the financial results are satisfactory it will be possible to raise 1,500 head for export next year. It is especially encouraging to note an increase of interest in Matabeleland, from whence some excellent bullocks have been furnished by breeders who have not participated in this trade previously.

This export trade of cattle with England is one of the most hopeful features of the cattle industry of this Colony, for it offers the possibility of a relatively unlimited market, so far as this Colony is concerned, at a definite price. The main obstacle to the expansion of the trade at present is the high cost of export—approximately £14 per head. The Department of Agriculture is making every endeavour to reduce this cost, and it is hoped that the shipments which are projected next year will be marketed at an appreciably lower cost.

Cystine.—Reference is occasionally made in the agricultural Press to cystine, a recent feeding stuff discovery which is obtained from waste hair, wool, horn, hoof and the like. It is now being manufactured in Australia by the Metropolitan Meat Board of Sydney, and used for the purpose of feeding sheep on hard feed conditions due to and following on periodic droughts or to frosts in the highlands or to floods in the river territories. It is said that cystine-rich foods favour wool growth and prevent "break" in the staple, and it is believed that the discovery of this foodstuff will assist materially in the improvement of the quality of wool.

It is thought that a few notes on the properties of cystine will be of interest to readers, and we therefore append the following reference to the subject supplied by the Chief Chemist. We might here mention that experiments with cystine are now being conducted at the Onderstepoort laboratories, near Pretoria.

Proteins, which form the greater part of the solid matter of all animal tissues, are complex substances composed of a number of what are termed by the chemist amino-acids. Altogether some 18 different amino-acids are known to form constituent parts of proteins, but the number and percentage

of these amino-acids vary considerably in different types of proteins. Cystine is one of these amino-acids, and it differs from the others in the fact that it contains as part of its constitution the element sulphur.

Many of the common proteins contain very little cystine, but a gelatinous substance obtained from the hoofs, nails and hair of animals called keratin is particularly rich in cystine. This amino-acid is also present in fair quantity in sheep's wool, from which it can be readily obtained.

It is quite possible that sheep on a spare protein ration would receive considerable benefit from a substance rich in cystine, but careful feeding trials would need to be carried out on sheep before this amino-acid could be fed indiscriminately.

Southern Rhodesia Egg-Laying Test.—The eleventh egg-laying test, which commenced on 1st March, 1930, and terminated on the 30th January, 1931, was the most successful test yet held in this Colony. Apart from the condition of the birds, which was excellent all through, it is gratifying to note that ten pens exceeded the 1,000-egg mark, the highest being 1,143 eggs and the lowest 1,002 eggs, for the 48 weeks' duration of the test. Ninety-two birds laid over 200 eggs during this period. Thirty-two birds have been retained to complete the 52 weeks period as possible producers of 250 eggs and more. Thirty-three birds have exceeded 220 eggs 2 ozs. and over, and 14 birds laid over 240 eggs 2 ozs. and over. Two birds, an Australorp and a White Leghorn (Rhodesian bred), are likely to reach or exceed the 300-egg mark for this period. These figures exceed the records of any previous test held in this Colony. The birds may be said to have done justice to the new single pens that were constructed for this and subsequent tests. The following competitors may be congratulated on the performance of their birds:—Light breeds: Mr. H. T. Lay, P.B., Salisbury, who owned the winning pen; Mr. R. Porritt, of Maritzburg, and Mr. G. Hourquebie, of Rosetta, Natal, who gained second and third places respectively; Miss Betty Russell's pen gained fourth place. In the heavy breed section Mrs. G. R. Syfret, of Salisbury, is the owner of the leading pen, and the pens entered by Mr. R. Raynor,

Mr. Sam Stewart and Mr. G. Hourquebie were placed second, third and fourth respectively. Several pens changed hands at a good figure.

The accommodation for the next test, which commences 1st March, 1931, has been readily taken up, and the pens at the time of writing are undergoing thorough cleaning and renovation to prepare for the new competitors.

Tobacco Farming in the Western Transvaal.—The February issue of *Farming in South Africa*—the journal of the Department of Agriculture—summarises the results of an enquiry conducted by the Division of Economics and Markets into the economic side of tobacco farming in the Western Transvaal. Data on farm management were obtained in respect of approximately 130 tobacco farms for the period 1st October, 1927, to 30th September, 1928.

The farms covered by the investigation are distributed as follows:—37 in the Rustenburg area, 24 in the Groot Marico area, 9 in the Magaliesberg Valley, 23 in the vicinity of Brits, 16 on the Mamagalieskraal Settlement, and 22 in the Nylstroom area. In the analysis the data for these areas were dealt with separately as well as collectively, so that an average could be obtained for each group as well as for the whole area. The average capital investment for all farms was £2,321. On almost every farm tobacco-growing formed the main enterprise, wheat and maize, and to a lesser degree dairying and poultry, being regarded as side-lines. The item "crops sold" was responsible on the average for 85.7 per cent., "stock sold" for 10.3 per cent., "animal products" for 1.7 per cent. and "other receipts" for 2.3 per cent. of the total cash receipts. To the crop receipts tobacco alone contributed 64.5 per cent., or 55.27 per cent. of the total cash receipts. The important part played by tobacco in the farm organisation of these areas is thus evident.

The cash receipts per farm amounted on an average to £275.1 and cash disbursements to £251.5, of which 40 per cent. represented hired labour. After deducting all disbursements from receipts, the average net income amounted to £124. By further deducting from this sum the value of

the labour done by members of the family (operator's labour not included), as also the interest on the average capital investment, the figure known as the "operator's earnings" is obtained. This, on an average, amounted to £4.57 per farm, and represented the return the operator received for his year's labour and supervision. It is clear, therefore, that farmers generally had to content themselves with very little during the year. In addition to the £4.57 which the average farmer received, the household also consumed products to the value of £48.4 per family.

The net cash family income was only £42.4 per farm. This was the actual cash amount which remained to the farmer and his family for the purchase of such necessaries as could not be produced on the farm.

As tobacco plays such an important role in the farm organisation in these areas, a more comprehensive study was consequently made of this enterprise. It was found that those farmers who produced tobacco of the best quality and obtained the highest yield per morgen received, almost without exception, the highest returns.

Transport of Maize by Road Motor Services.—Particulars are now available, per Rhodesia Railways Bulletin No. 49, regarding the participation of the Rhodesia Railways road motor services in the transport of the 1930 maize crop. This new feature in the economic life of Southern Rhodesia has engaged the special attention of the administration, and it is gratifying to learn not only that the new form of transportation is proving a satisfactory feeder to the main and branch lines of the railway system, but that it is meeting with the support and appreciation of the farming community.

During the 1930 maize season (June to October), 23,315 tons of maize were carried by road motor service vehicles. The comparable figure for the 1929 season was 15,708 tons, so that the additional tonnage of 7,607 represents an increase of 48 per cent. The average length of haul was 22 miles and the maximum haul for any consignment was 77 miles. The bulk of the traffic was conveyed to six stations on the railway system, and smaller quantities were moved to six

other stations. The total mileage run by vehicles in transporting the 23,315 tons of maize amounted to 85,822.

Two types of lorries were employed. One is known as the Thornycroft improved "E.C." six-cylinder 5-ton lorry, normally hauling two 5-ton Carrimore trailers (total maximum paying load, 15 tons), and the other is the Thornycroft "X.B." long, four-yclinder 5-ton lorry, normally hauling one 5-ton Carrimore trailer (total maximum paying load, 10 tons). Six of the former and 17 of the latter were utilised in last season's transport. The bulk of the mileage was performed by the "X.B." type of lorry hauling one trailer, although a study of working costs indicates that the "E.C." type gives the more economical result per ton mile, and, from last year's experience, is generally the more satisfactory vehicle.

Certain difficulties were experienced in trailer couplings, but the administration hopes that these difficulties have now been overcome and that in future entirely reliable service may be expected from the employment of trailers.

One of the most important points in the operation of what might be termed these "farm road motor services" concerns the co-relation of the type of vehicle with the condition of roads and land over which it has to pass. In most cases the last few miles of haul to the railway station is over a good gravel road, but as the loads are picked up actually on the farms themselves, transport over tracks of the roughest description is involved with gradients up to 1 in 5. In the case of some of the longest hauls last year, the whole road was an unmade dirt track. Although dry weather considerably facilitated the movement of vehicles, yet the makers of the lorries are to be congratulated on the evolution of a type of vehicle which is standing up to the severe conditions imposed by the physical nature of the country to be negotiated, and yet retains the faculty of a normal road vehicle for almost any kind of public service.

An interesting feature has been noted in connection with the operation of "farm road motor services." Except, possibly, in the heaviest wet weather, it is considered that road motor vehicles improve the surface of gravel and dirt roads. It is asserted with some degree of confidence that,

even in the wettest weather, they do not do anything like as much damage as animal-drawn transport which the motor vehicles are displacing.

Death of Mr. T. Hamilton.—It is with great regret that we record the death of Mr. T. Hamilton, Chief Dairy Expert, which occurred at his residence in Salisbury on the morning of the 17th February. Mr. Hamilton had for some time been indisposed, but news of his demise came as a great shock to his colleagues, who did not know that his condition was so serious.

Mr. Hamilton, who was a Master of Arts of Cambridge and also held the National Diploma of Agriculture and the National Diploma of Dairying, came to Southern Rhodesia from the Union Service in 1920 and was charged with the task of organising the dairy industry of the Colony. Possessed of sound judgment and not inclined to take things at their face value, Mr. Hamilton was well equipped for the difficult undertaking, and how he acquitted himself is shown by the remarkable progress the dairy industry has made in the past decade. His work was by no means finished, but he has laid the foundations of a sound industry and one which is destined to play a conspicuous part in the development of this young Colony.

The funeral, which took place on the afternoon of the 18th, was attended by the Premier and most of the officers of the Department of Agriculture, as well as by numerous members of the general public. In Mr. Hamilton the Government has lost a valuable servant, the farmers a tried and trusted helper and the staff of the Agricultural Department a much liked and respected colleague.

We tender our sincerest sympathy to the relatives of Mr. Hamilton residing in the Old Country.

Irrigation Canal Structures.

By R. H. ROBERTS, B.Sc.(Eng.), Assistant Irrigation Engineer.

Good structures form just as important a part of an irrigation scheme as the furrow itself, and their absence always leads to unnecessary waste of water, time and money.

It is proposed in this article to discuss the structures which are most likely to be required in a scheme of moderate size, such as is most common in Southern Rhodesia. Space will not permit of more than a general description of each, and special cases should be referred to the Irrigation Division for detailed advice.

The following classes of structure will be discussed:—

(1) Intake works (head-regulator gates, etc.).
(2) Sluice gates.
(3) Spillways.
(4) Flumes.
(5) Inverted syphons.
(6) Gauging weirs and notches.
(7) Road crossings.
(8) Drops.

The actual weir or dam is not included, since many types have been dealt with in past issues of the *Rhodesia Agricultural Journal*, viz., "Weirs and their Construction" (April, 1923), "Small Earthen Storage Reservoirs" (November, 1927; reprinted as Bulletin No. 660), and "Low Concrete Dams" (June, 1930; reprinted as Bulletin No. 786).

Intake Works.—A gate at or near the intake of a furrow serves two important purposes—it makes it possible to regulate the amount of water admitted to the furrow and it prevents the entry of flood water. With the latter object

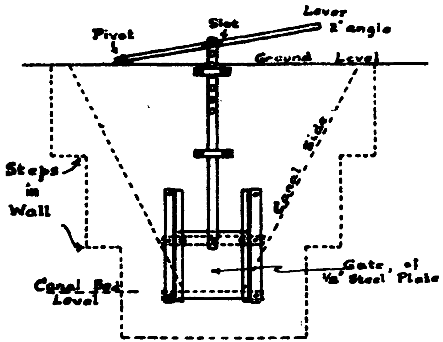
in view, the gate should be placed at the point where the furrow line crosses the high flood level of the stream, and the wall behind the gate should rise above this level.

A suitable arrangement for the average scheme will consist of a masonry or concrete wall (with or without an earth backing) pierced by a culvert which is controlled by a sliding gate. The culvert may be of brick or concrete, roofed with corrugated iron, or it may be one of the culverts specially manufactured for the purpose, such as the "Armco" nestable culvert.

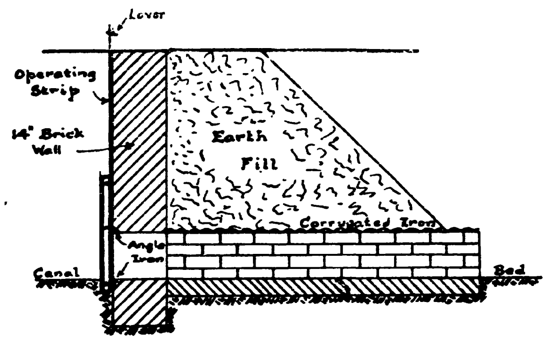
Part of fig. 1 shows head-gate works of a home-made variety, with a device to prevent leakage, which is the chief difficulty. Two small portions of each guide angle-iron "B" are bent backwards, so that when the gate is lowered it is wedged tight both top and bottom. The top clearance must, of course, be greater than at the bottom, and the gate is correspondingly thickened at the top by riveting on small pieces of ⅛-inch metal. There are also several types of proprietary gates on the market suitable for head-works, such as the outfit illustrated in fig. 1.

The gate should be closed during the rainy season whenever water is not required, so as to prevent rushes of flood water down the furrow. The length of furrow upstream of the gate is, however, subject to floods, and in certain cases it may be necessary to protect it by a lining of concrete or galvanised iron, and in almost every case it is advisable to allow the surplus water to be discharged as readily as possible. This is best done by a spillway and sluice installation just upstream of the head-gate, which is described in a later paragraph.

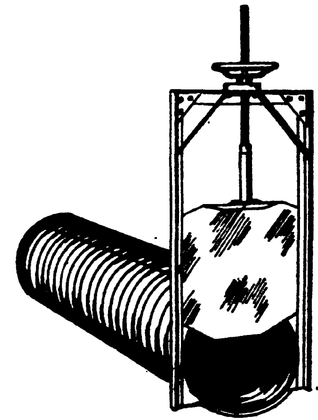
Sluice Gates.—There are several types of sluice gates, which are used for such different purposes as stopping, diverting, regulating or draining the flow of water, either in the main or the subsidiary furrows, and therefore there can be no "general" or universal gate. The modern tendency is towards the use of all-metal, rustless gates and frames, but gates are still commonly made of wood, wood and concrete (or brick) and steel and concrete (or brick). Included in fig. 2 is a sluice gate which may easily and cheaply be made on the farm. The opening is formed by a sill and pillars of brick and cement, with guides of light



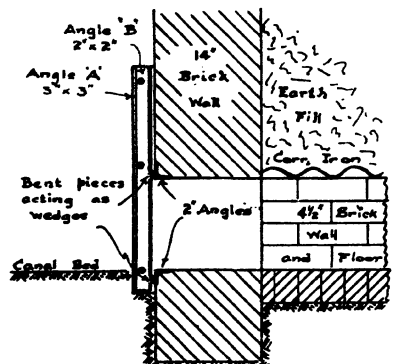
FRONT VIEW

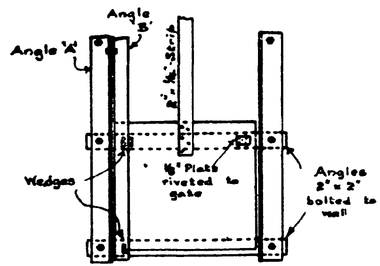


LONGITUDINAL SECTION



SCREW-OPERATED GATE
WITH
CIRCULAR CORRUGATED CULVERT
[With acknowledgments to 'Calco' Head-gate, made by the California Corrugated Culvert Co.]





NOTE: ANGLE 'B' REMOVED ON THE RIGHT, TO SHOW GATE.

TYPICAL HEAD-GATE INSTALLATION

FIG. 1.

HEAD-GATES

IRRIGATION DIVISION
SALISBURY.

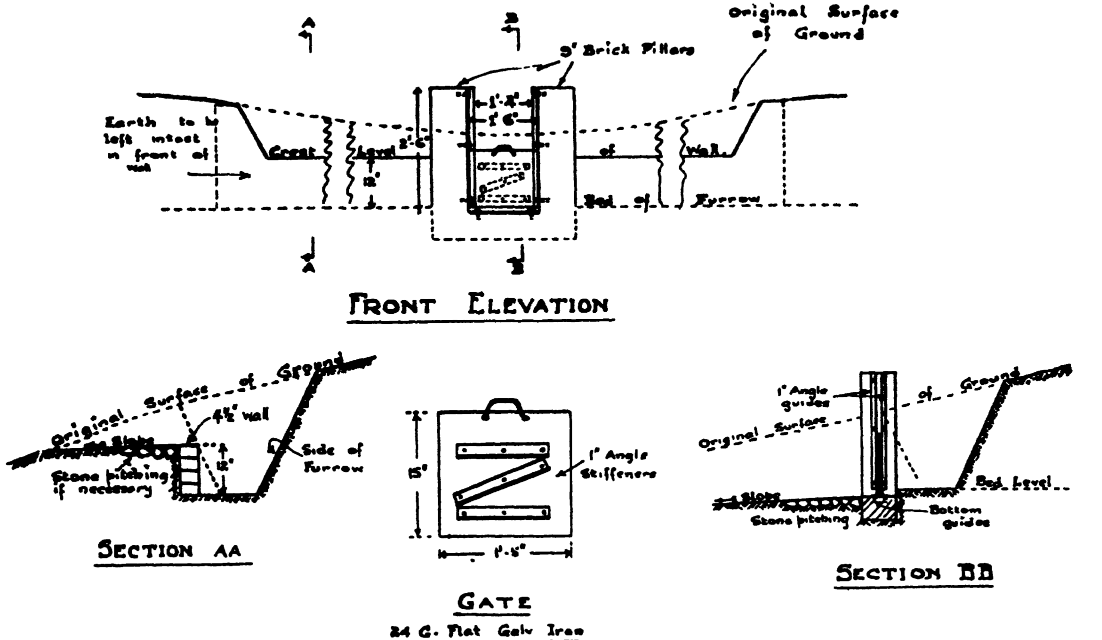


Fig. 2.

Spillway and Sluice-Gate Works.

Irrigation Division
Salisbury

angle-iron bolted and cemented into place. The gate itself consists of a piece of flat galvanised iron, stiffened by three short lengths of 1-inch angle-iron. If the gate is made of wood, it should be remembered that wood swells considerably when wet, and the guides should be fitted to the thickness of the gate after the latter has had a thorough soaking.

These gates are of a permanent nature, for controlling flow in main furrows and in permanent distributaries, but in the small field furrows a temporary or movable type of gate is needed. A "canvas dam" is a useful article and is made of a square of stout canvas, one edge of which is secured to a stick a little longer than the furrow is wide (see fig. 4). At the place where water is required to be diverted, the canvas is lowered into the furrow, kept down by a clod or two of earth, and the pressure of the water will keep it in place until water is required elsewhere, when the "dam" is pulled up and moved on. Another device consists of a semi-circle of flat galvanised iron, which is simply pushed into the wet soil of the furrow; if desired, a few holes may be drilled to allow a small quantity of water to flow beyond the obstruction. Old plough discs are often used in the same way. Any of the above devices may be used, and all are better than the system of digging out masses of "dagga" to block the furrow, which results in large holes being dug in the ground near-by.

Spillways.—The object of a spillway in a furrow is to discharge any water in excess of what is normally required, and therefore a spillway usually consists of a masonry wall with its crest at the normal level of the water in the furrow. The length of the spillway depends on the quantity of water to be dealt with, and is also governed by local conditions, such as the situation, the size of furrow and type of soil. The best position for a spillway is at a natural drainage line, especially if rock is exposed, so that scour will not be caused. At such places it often happens that the most convenient way of crossing is behind a wall or weir of masonry, which therefore will also act as a spillway. Spillways should be installed about every half-mile of the furrow, but this distance will, of course, depend upon the local conditions. In general, it is better to have a number of spillways closely spaced than a few larger spillways.

A useful accessory of a spillway is a sluice gate built into the wall with its sill level with the bottom of the furrow. By raising this gate during periods of heavy rain the furrow is completely drained and a scouring action is set up which washes out accumulations of silt in a very effective manner. Such gates may, of course, be installed even at places where a spillway is not justified or possible. Fig. 2 shows a combined spillway and sluice gate installation. Sometimes a second gateway is built across the furrow just downstream of the side gate, so that the gate may be removed entirely from the spillway and replaced in the second position to block all flow down the furrow. The two sets of guides must, of course, be identical if the same gate is to be used.

The discharge channels should be stone-pitched for a few feet to prevent erosion, unless the natural surface is sufficiently stony.

Flumes.—A great variety of flumes or aqueducts have been used, but what is chiefly called for in Southern Rhodesia is a structure which is cheap, effective, reasonably permanent and simple to erect. Most of the schemes in Southern Rhodesia are of the small, individual type, which seldom use flows greater than two cusecs. For larger schemes or specially difficult cases it is advisable to apply for expert advice and design, but the flume shown in fig. 3 will, it is hoped, prove suitable and useful in the majority of cases. Several flumes have been built according to this drawing at a cost of under 7s. 6d. per foot length, including foundations and abutments. The flume consists of sheets of standard 6 feet x 3 feet flat galvanised iron bent lengthwise into rectangular trough shape and supported by nailing to 6-inch x 2-inch timber bearers.

Long ½-inch bolts pass through the bearers every 4 feet, and thus secure them to the tops of the trestles and braces. The bearers are stiffened and kept the proper distance apart by 8-inch lengths of ¾-inch pipe acting as distance pieces. Joints between adjacent troughs are overlapped 6 inches in the direction of flow and bolted or riveted together. The joint may be made more watertight by a strip of felt, but this has not usually been found necessary if the work has been carefully done.

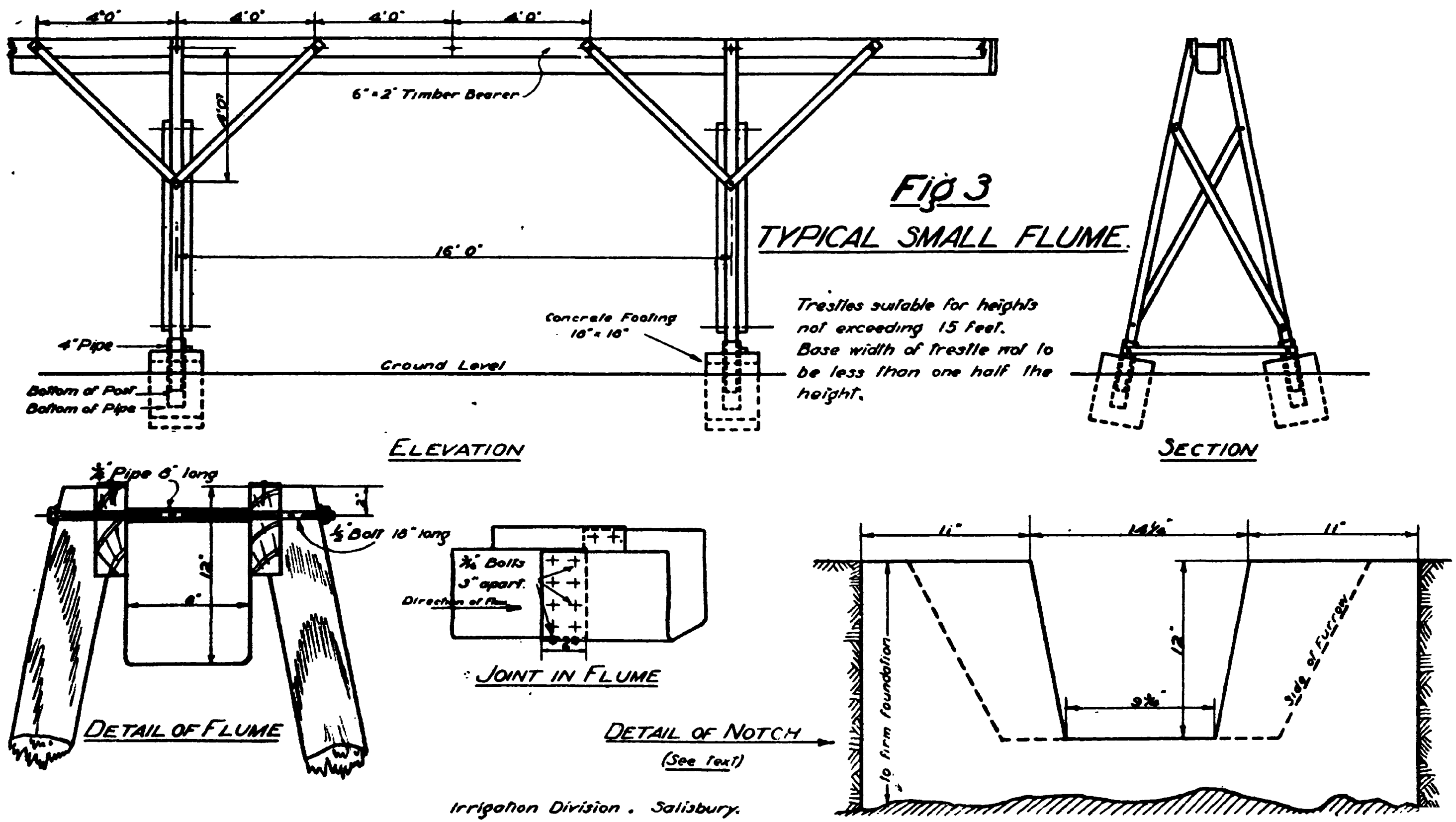
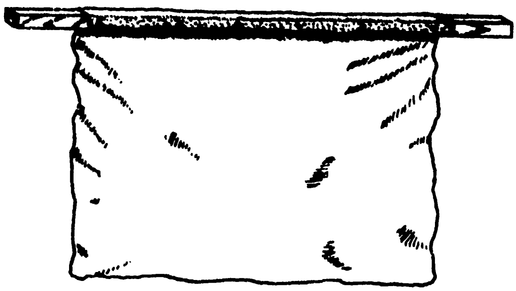


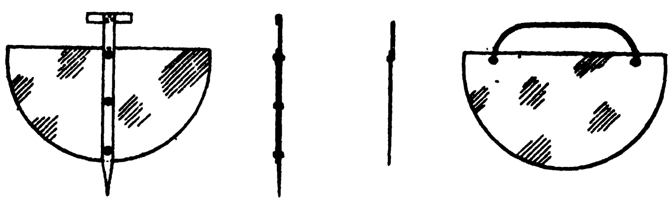
Fig 3

TYPICAL SMALL FLUME.

The flume is supported every 16 feet by trestles, which may be of native timber, but preferably of piping or steel-work. The footings consist of concrete blocks of adequate depth, into which, if timber posts are used, lengths of 4-inch pipe are set, so that the timber may be easily renewed, and is made safer against attack by ants. Posts should be 4-inch diameter timber and bracing 3-inch diameter. In all cases ½-inch bolts should be used.



Canvas Dam



Metal "Tappoons".

FIG. 4.

[With acknowledgments to "Irrigation and Land Drainage" by W. Gibbons Cox, C.E.]

The flume will discharge 1.0 cusec with a fall of 1 in 250 and 2.0 cusecs with a fall of 1 in 69, allowing 9 inches depth of water.

Care has to be exercised as to the arrangements at the entrance and exits of a flume. At the entrance the conditions of flow have to be gradually changed from the slow discharge in the furrow to the high velocity down the steeper gradient of the flume, and at the exit the energy of the fast-moving water must be dissipated without damaging the

furrow or causing overflow to take place. This dissipation of energy can often be secured by building a "stilling pool" deeper than the furrow, followed by a few feet of rough stone pitching. At the entrance the best device is known as a "notched fall," which is simply an opening in a concrete wall narrower at the bottom than at the top. The exact dimensions of this opening will vary for each case, and will be calculated by the Irrigation Division if application is accompanied by particulars of maximum and minimum flow in the furrow, the gradients and dimensions of furrow and flume.

As a typical case we will examine the following conditions:—

Furrow.—Maximum discharge, 2.0 cusecs; minimum discharge, 0.5 cusec; gradient, 1 in 1,000; bed width, 1.5 feet; side slopes, ½ to 1; water depth for maximum flow, 11½ inches; water depth for minimum flow, 5½ inches; velocity for maximum flow, 1.05 feet per second; velocity for minimum flow, 0.68 foot per second.

Flume (as illustrated in fig. 3).—Gradient, 1 in 69; water depth for maximum flow, 9 inches at 4.0 feet per second; water depth for minimum flow, 3 inches at 3.1 feet per second.

Then the opening of the "notched fall" should be 9¾ inches wide at the bottom (same level as bed levels of furrow and flume) and 14¼ inches wide at a height of 11½ inches.

The metal work of the first sheet of the flume should be gradually altered from this shape to the shape shown in the drawing.

Just before reaching the entrance to a flume a spillway and sluice gate should be installed whenever possible, so that surplus water will be discharged and will be prevented from flooding the flume.

Inverted Syphon.—It sometimes happens, either because of the lack of proper foundations or because of the risk of damage from trees, etc., brought down by certain streams in flood, that a flume on trestles is impossible or dangerous. One alternative is to hang the flume from a cable, as with a suspension bridge, but there are objections to this method with small flumes.

In these cases it is worth considering a syphon crossing, consisting of a pipe laid down each bank and under the bed of the stream. The size of the pipe will depend on the quantity of water and on the available fall between entrance and exit of the syphon. Thus where there is 2 feet fall in 100 feet of pipe, a 6-inch pipe will carry 1.0 cusec.

One of the troubles consequent upon the use of a pipe syphon is the tendency to accumulate silt in the lowest part of the pipe. Hence it is nearly always advisable to provide a branch pipe with a valve at the lowest point, so that by opening the valve the entire syphon may be scoured out.

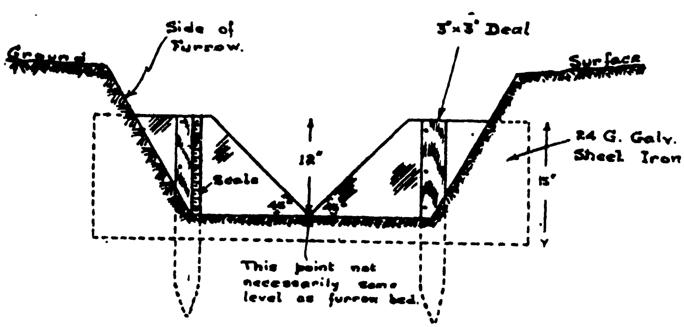


FIG. 5.

RIGHT-ANGLED V-NOTCH

For Furrow discharging 2½ cusecs maximum

Gauging Weirs and Notches.—An accurate knowledge of the quantity of water is a great help towards successful irrigation. It does away with a lot of guess work in the application of water and enables records to be kept of the amount of water applied to each field for any particular season, thus making for consistency.

Among others, what is known as a "V notch" will be found especially suitable for the average scheme using not more than 2½ cusecs. This is reasonably accurate, easily read, cheaply made and simple to instal. It consists of a sheet of galvanised flat iron (or brass), out of which is cut a V-shaped notch 12 inches deep and 24 inches wide at the top. The angle at the apex is a right angle. This sheet is fixed across the furrow on timber or masonry supports (as shown, fig. 5) at a place below which is available a fall of

12 or 18 inches, so that the water may fall clear over the notch. Care must be taken in cutting and fixing the notch that the angles are exact and that the top of the sheet is dead level. On the upstream side of the sheet and at the side of the notch rivet on a scale of inches, with the "0" of the scale exactly level with the point of the V.

Then all that is necessary is to read the depth of water shown by the scale and look up the corresponding discharge in cusecs from the following table. The depth must be carefully read, because, as will be seen, a small difference in this figure means a big difference in the number of cusecs. The "V notch" is more accurate in this respect than most other measuring devices:—

Depth, in inches, over bottom of V.	Discharge in cusecs.
2	0.03
3	0.08
4	0.16
5	0.29
6	0.45
6½	0.55
7	0.68
7½	0.78
8	0.92
8½	1.06
9	1.24
9½	1.42
10	1.61
10½	1.82
11	2.04
11½	2.30
12	2.54

Road Crossings.—A road crossing is an item which is needed on almost every irrigation scheme, and all too often takes the form of a wide, trampled, muddy drift, which, besides being an eye-sore, results in waste of water. Even if it is only a farm road, it is better to put in some form of culvert.

The simplest scheme is to use one of the circular corrugated iron culverts with a brick wall at each end raised a few inches above road level and painted white. But if this

is too expensive, a culvert may be built of two brick walls and a suitable roof. It is in the roof that trouble frequently is found. Timber is unsatisfactory, as the road material falls into the furrow through the spaces between the poles. Steel railway sleepers cut in half are useful but expensive. Cut-up sheets of corrugated iron can be used to advantage with small furrows, but a double layer may be necessary if the space between the brick walls is too great. Brick arches, slabs of stone or concrete are other solutions.

In any case it is advisable to locate the furrow so that it may be of extra depth at the point of crossing. If this is done a good thickness of road material can be maintained over the culvert roof without producing a sharp hump.

Drops.—It is often necessary to drop the level of a furrow suddenly to fit in with the slope of the ground. The drop may be great, as in the case of a main canal on a steep hillside, in which case the drop may take place down a sloping cemented channel with a stilling pool or rough stone-pitching at the foot to break the force of the water. A drawing of such a "rapid" is available in the Irrigation Office.

It is the other extreme, that of a drop of a foot or two in a small furrow, which is more common, especially with distributary furrows running down a field. If the ground slope is great, it will pay to go in for a continuous lining of brick or concrete. But if the slope is only, say, 1 foot in 40 or 50, then the more economical solution is to dig the furrow in nearly-level reaches of 60 or 70 feet, and instal a small brick or concrete drop at these intervals to produce the necessary drop to the next section of furrow. For example, take a slope of 1 in 50 and assume a drop every 75 feet. In the 75 feet there is a fall of 18 inches. Allow 3 inches for the gradient of the furrow (1 in 300). Then each drop will be 15 inches. The furrow will be, say, 6 inches deep at the head of the drop, and 21 inches deep at the foot of the drop.

A suitable design for a 15-inch drop would be a vertical 4½-inch wall across the furrow, carried extra high up the sides. (Where it is desired to gauge the flow at the same time, then a V notch as in fig. 5 may be used instead of

the vertical wall.) It is essential to put in an "apron" of brick or stone in the bed of the furrow below the drop for a foot or two, to prevent the formation of pot-holes, and it is advisable to put in a similar but smaller apron just above the drop, and to line with brick the sides of the furrow above, at and below the drop for a foot or two.

For vertical drops in major furrows the top opening of the vertical wall should be in the shape of a notched fall, as referred to above in connection with flumes. The size and shape of the notch must be calculated for each individual case. The object of the notched fall is to prevent a dangerous speed of the water approaching the drop, which might set up serious scour.

SUMMARY.

1. Time, labour and money are often wasted by the want of proper structures.

2. Efficient permanent structures can be erected at but little cost if a little ingenuity is used.

3. It pays to use proper sluice gates (permanent or movable) in the field, instead of digging lumps of mud.

4. A gauging notch is inexpensive, but may make all the difference between the success and failure of a crop.

5. Use permanent materials wherever feasible.

6. Head gates, spillways and sluices will protect your furrow in times of heavy rain, and also help to get rid of accumulations of silt.

7. Apply to the Irrigation Division for drawings and advice on any special problem which is not dealt with in this article.

Selection of Tobacco Seed Plants.

By H. F. Ellis, M.Sc., B.Sc.(Agr.), Tobacco Adviser.

There is probably no field crop grown in Southern Rhodesia which presents a greater necessity for careful seed selection, in accordance with the latest and most improved methods, than does tobacco. This need is plainly apparent in practically any tobacco field in this Colony where great variation between individual plants may be seen and where the yield generally is low. This variability results in a large proportion of the crop being poorly adapted to the purposes for which it is grown, and greatly increases the cost of harvesting and grading.

An occasional crop is found which is true to an established type, but for the most part uniformity is lacking, and often as many as half a dozen distinct types can be found recurring in the same field; each of these types may differ in yield and quality as well as in adaptability to the common requirements. Individual plants within a type may differ widely in shape, size and number of leaves, time of maturity, size of vein and texture of leaf. These differences are often put down to soil variation; but while this is no doubt partly responsible, it cannot possibly account for all the variations observed. It is not uncommon to find two plants growing side by side, one of which carries 20 leaves and the other only 12.

Breeding experiments conducted in America have conclusively demonstrated the possibility of securing considerable increase in yield and great improvement in the uniformity of type, and of the individual plants within the type, by seed selection.

In order to obtain this uniformity and trueness to type it is absolutely essential that all seed set by the plant should be self-fertilised. The tobacco plant is normally self-fertile,

but should the flowers all be permitted to open it is very probable that at least half of the seeds may be cross-fertilised, which will give a corresponding lack of uniformity in the resultant plants.

Experiments conducted by the United States Department of Agriculture have demonstrated the absolute necessity of bagging the tobacco flowers in order to secure uniformity in the crop. Plants grown from seed without such protection showed considerable irregularity of type, while those from bagged seed were remarkably uniform in every particular. Self-fertilised seed was found to produce more vigorous crops than could be grown from seed cross-fertilised within the variety.

Under normal circumstances the bulk importation of improved varieties from other areas or districts is not believed to be desirable. Such importations are usually disappointing in respect of yield and quality, and are of little value until several crops have been grown from such seed and the variety has been acclimatised. Seed to be selected should be from the best types in the area where the tobacco is grown, thus guarding against the possibility of losses incurred during the process of acclimatisation. The difference in the character of soil even on adjoining farms is often so marked that it is essentially important that the grower should select his seed from his own field if a desirable type can be found there.

It is possible for every grower to select the type of plant he desires to grow and to secure uniform types or strains like the parent plant. In view of the fact that any improvement in the yield or quality secured by seed selection is pure profit—since it costs no more to grow good plants than poor ones—there is no farmer who can afford to grow the poor type of tobacco so frequently seen.

Method of Seed Selection.—Two selections should be made in the field, a preliminary selection of a large number of plants and a final selection from among the plants chosen in the first instance. The first selection should be made just before the flowers begin to open and before any pollination occurs. The grower must decide upon that type of plant which most nearly constitutes his ideal, and should select only that type which he thinks will produce the largest yield

of the class of tobacco adapted to the purpose for which it is grown. With this ideal in mind the grower should go over the field row by row, selecting only those plants which conform or nearly so to this standard. The main factors which should be borne in mind when selecting seed plants are the following:—

(1) The plant should be free from disease, particularly such diseases as angular spot, wildfire and mosaic. Seed produced from plants infected with either of the two former diseases will in all probability carry the disease over to the succeeding crop, while seed produced from mosaic plants, though not necessarily infectious, will be small and lacking in vitality.

(2) Plants should be selected which are stocky and robust and carry a large number of leaves spaced at a short distance apart.

(3) The plants finally selected for seed purposes should be early maturing, and, particularly in the case of fire-cured tobacco, the majority of the leaves should ripen at the same time so as to give uniformity when harvested.

(4) The plants should all be true to type. Only one particular type or strain should be selected, and if there is more than one such type in the field, the seed from the two types selected should be kept separate.

(5) The following leaf characteristics should be sought:—

- (a) The leaf should be a dark, healthy green colour, of good size, long and fairly broad.
- (b) The system of venation should be fine.
- (c) The leaf should possess a large amount of gum and oil.
- (d) The ruffle at the base of the leaf should be small.

(6) In the final selection plants should be kept which have required the minimum amount of suckering, as this characteristic is hereditary and consequently capable of modification.

General Method of Bagging Plants and Obtaining Seed.—After the selection has been made, some means must be employed to protect the seed head from cross-pollination

by insects. This can be done very cheaply and efficiently by tying a "14-lb." paper bag over the head. Before this is done the seed head should be properly prepared. The head should be trimmed down to three strong shoots, generally known as a "crowsfoot," and the leaves removed from the stem below the head to the height at which the plant would normally be topped. This enables the plant to set bigger and more viable seed. At the same time any flowers which have already opened are removed in order to prevent any possibility of a part of the seed being cross-pollinated.

The bag should be placed over the seed head just before the first flowers open, and should be tied to the stem in such a manner that in growing the shoots will not burst through the bag. At the end of each week, for two or three weeks, the bag should be lifted and re-tied in such a manner as to give the plant head the maximum room for expansion. The seed head should be lightly dusted with lead arsenate in order to control to a certain extent the tobacco budworm. After the majority of the pods are properly set the covering may be removed and any unopened or open flowers removed. As, however, the bag must be replaced before harvest, there is little advantage in doing this. When the seed heads are fully matured the stalk should be cut, leaving a length of probably two feet of stalk terminating in the seed head.

The heads with their covering should be hung up where there is a free circulation of air until the seed is thoroughly dried out. The bag should be retained on the seed head as a protection and to catch any seed that may drop from the capsules. When the heads are thoroughly dry the seed should be separated from the pods. In order to avoid difficulty in the subsequent cleaning, the seed should be extracted by opening the top of each pod and shaking out the seed. Generally speaking, this gives better results than thrashing the whole seed head in a bag, as appears to be the method in general favour at the moment.

No definite figures can be given as to the amount of seed furnished by any one plant, but it appears probable that it requires from 8 to 12 seed heads to give one ounce of cleaned seed.

A Preliminary Note on Clovers in Southern Rhodesia.

By S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

Southern Rhodesia is unfortunate in possessing practically no indigenous legumes which can be utilised in temporary or permanent pastures for increasing their feeding value and palatability. Great Britain possesses the White or Dutch clover, which is so valuable a constituent of its pastures, but despite many years of patient investigation by this Department and the trial of a great number of legumes from all over the world, no plant has yet been found which can take the place in our dry land pastures that the clovers occupy in the pastures of Europe.

It may be well to mention here that it has been shown that where legumes and grasses are grown together, the grasses will contain a considerably higher percentage of nitrogen or protein than where they are grown alone under the same conditions. This helps to explain the great increase in feeding value which the presence of clovers is known to give to a pasture, which could hardly be explained by the high protein content of the clovers alone.

In recent years considerable effort has been directed towards ascertaining the most suitable legumes for inclusion in pasture mixtures for irrigated land and for the moisture-retaining soils of the so-called "wet vlei" lands of the Colony. Although much work in this direction remains to be done before any comprehensive recommendations can be made, it is considered that a short preliminary note on the results so far obtained may be of interest.

Of the numerous clovers which have been under trial, those which show most promise of being useful are Wild White, the ordinary White or Dutch, Subterranean and

Subterranean clover on sandy wet vlei. Transplanted in November, 1929. Vlei dried out and clover died off in September, 1930. Photograph taken 10th January, 1931, shows new growth from self-sown seed 9 inches high. Soil completely waterlogged.

White clover grown under grasses where grass throws no shade (foreground). Clover has not thriven, but where grass throws heavy shade the clover flourishes (background).

Clovers in wet vlei land, 1st May, 1930. Unfertilised in background (hardly visible). Fertilised with 200 lbs. phosphates per acre in foreground.

Ordinary White or Dutch clover growing under msasa tree with irrigation.

Palestine clover and Alsike. All these have grown well under irrigation or on land which remains permanently moist, but the Wild White and Dutch varieties have given better results than the others.

On those vlei lands which *normally dry out during the latter part of the winter*, or which dry out after exceptionally dry seasons, the only clover which appears likely to be of use is the Subterranean. This clover, if it has been sown or planted early just before the first spring rains, freely forms seed, which it buries just below the soil surface in a similar manner to the ground nut, and with the advent of the rains in the following spring, this seed germinates readily and the clover grows up strongly, and appears to hold its own very well in competition with the common weeds of vlei land. In South Australia this clover is remarkable for the fact that it is an excellent weed-smothering crop, and that it will make good growth on really "sour" soils. This appears to be true of its behaviour here, for it has been found to smother sorrel and some other weeds, and it thrives on wet, sandy vlei land which is normally inclined to acidity. It may be well to add that Subterranean clover appears to have an even greater need of an ample supply of phosphates than the other clovers, and it is recommended that no attempt should be made to grown Subterranean clover, or, indeed, any of the clovers mentioned above, unless phosphate deficiency in the soil is first made good. Dressings of wood ash or lime prior to sowing or planting out are also beneficial.

Subterranean clover is an annual, but owing to its ability to make new and rapid growth each year from the seed which it has thrust beneath the surface of the soil, it behaves for all practical purposes as a perennial. A rider must, however, be added to this statement, for it is possible that on certain of the heavy black vlei soils of this Colony which form a hard crust on drying out, this clover may find it impossible to bury its seed under the surface of the soil, and so may be unable to reproduce itself under these conditions.

All the clovers mentioned may be sown *in situ* in the field, or may be propagated by splitting up the plants and transplanting. In the case of Subterranean clover grown on wet vlei land which may dry out and in a district where

the rains are usually late, it will probably prove best in the first instance to sow in seed beds and later transplant in the pasture. This method also economises seed.

The writer is strongly of opinion that one essential to the successful growing of clovers in this Colony is the provision of shade by suitable grass to protect the clovers from the continuous blaze of the sun during the dry season. Paspalum (*Dilatatum*), kikuyu, canary grass (*Phalaris bulbosa*) and Hunyani grass are suitable for this purpose on irrigated lands, while on wet vlei land paspalum, swamp couch, and in certain areas kikuyu and possibly other grasses too, should be suitable. In an experiment designed to test this point carried out at the Agricultural Experiment Station, Salisbury, it was remarkable that the clover (White) thrived best where the grasses grew most strongly, and *vice versa*. A number of cases have been noted also in the field in which a patch of weeds, or grass, or a bush has provided partial shade which has obviously benefited the clover. White clover has grown strongly in close competition with a thick stand of kikuyu grass on one permanently wet vlei in the Lomagundi district.

On irrigated land, or permanently wet vlei land, the best time for sowing is probably in the autumn, in March and April, as weeds are then not likely to be too troublesome, but sowing may also be done in the early spring, in August and September. On a wet vlei which dries out at the end of winter, Subterranean clover must be sown or transplanted as early as possible in spring, so as to lengthen the growing season to ensure seeding before the soil dries and the clover dies off.

A fine and clean seed bed should be prepared and the clovers and grasses should be sown or planted in alternate rows. The closer together the rows are, the more quickly will the ground be covered, and thus cultivation to suppress weeds will be reduced.

The distance between rows may vary from 15 to 30 inches, depending on the type of grass used. The phosphatic fertiliser, wood ash or lime, may be broadcast and covered by the disc harrow before sowing, but it is best to apply the ash or lime several months before planting or seeding.

The seed of clovers should not be covered more deeply than half an inch even on light, sandy soils, and on heavy soils it should be sown still more shallowly. It should be covered by a brush harrow.

To summarise briefly, it may be said that Wild White or ordinary White or Dutch clover appears the most promising variety for irrigated or permanently moist land, and should be grown with a shade crop of grass, which will also serve to give bulk to the pasture.

On sandy, wet vlei land which may dry out at the end of the winter only Subterranean clover appears to promise success, and should be sown or planted as early as possible in the spring to allow time to seed down before the soil dries out.

None of the clovers can compare in value with lucerne on suitable irrigated land for pasture, green soiling or hay, but on soil which is poorly drained, or has too high a permanent water table, or which in other ways is unsuited to lucerne, there is evidence that a mixed pasture of clover and grasses may successfully be established.

In conclusion, it should be stated that the utilisation of clovers in the pastures of this Colony is still in the experimental stage, and whilst farmers can be recommended to give these legumes a thorough trial, this should only be attempted at present on a small scale which will not entail any great expense.

Addendum.

Add the following after the word "appearance," page 187, line 19, February *Rhodesia Agricultural Journal*: "About 10 per cent. of the *Pinus pinaster* were vigorous, and it was noted that the good plants were always in groups. All the cypresses showed good growth."

Avocado Growing in South Africa.

By REDVERS J. BLATT, B.Sc., Ph.D.

[*We have pleasure in publishing this article by Dr. Redvers J. Blatt, who is an authority on the subject of the avocado. On the whole, the avocado has been found to do well in most parts of Southern Rhodesia, exceptions being a few districts of high altitude with low winter temperatures. Several varieties were introduced into Southern Rhodesia by the Government in 1928, and are being tested at a site in the vicinity of Salisbury. In addition, a number of enthusiasts are trying out varieties of budded trees obtained from the Union of South Africa. It is hoped in the near future to have available a considerable amount of data as to the merits or demerits of various varieties of the avocado over a fairly wide area of the Colony. It is also hoped at a later date to publish in this Journal an article by the Horticulturist on cultural methods advocated for the propagation of the avocado.*—Ed.]

Avocado growing is a very much neglected industry in South Africa, especially in view of the suitable climatic conditions prevailing in this country. Here we have enormous frost-free areas, yet we find very little use has been made of the favourable conditions to develop the semi-tropical fruit industry. In the Union of South Africa, Southern and Northern Rhodesia, Kenya and Tanganyika, the avocado can be grown to perfection, provided the latest and most up-to-date methods of avocado culture are adopted.

The Avocado in California.—California experiences severe freezes at times, yet its citrus industry is the largest in the world, and its avocado industry the model of the world. The first avocado was introduced into California in 1856, when Dr. T. J. White imported the avocado from

Nicaragua, together with other tropical fruit plants. It was, however, not until some years later that the avocado became definitely established through the introduction of three trees from Mexico in 1871 by Judge R. B. Ord, of Santa Barbara. In the years following this introduction many avocado trees were planted in California, some being imported from Mexico and the countries of Central America, others being started from seeds which travellers brought to California.

The period since 1910 has been marked by special emphasis on the commercial aspects of avocado culture. In place of relying on chance seedlings, nurserymen undertook the exploration of the avocado districts of Mexico and Guatemala. F. O. Popenoe and T. U. Barter, of the West India Gardens, Altadena, were pioneers in this field, and during 1911-12 brought in budwood of many varieties found in the best districts of Mexico. The Office of Foreign Plant Introduction of the Department of Agriculture of the United States then undertook the exploration of the avocado districts of Mexico and Central and South America with the hope of providing the young avocado industry in America with the best varieties. For nine years Dr. Wilson Popenoe, as an agricultural explorer, combed these regions, with the result that the avocado growers of California and Florida—and incidentally the growers of South Africa—now have the best varieties the world affords on which to build a commercial avocado industry.

In 1915 the California Avocado Association was organised, and its work has been one of the most important factors in the development of the industry. Its committee on registration and classification of varieties has rendered most valuable service in studying varieties and recommending those suitable for commercial planting.

In 1924 a co-operative marketing agency, known as the California Avocado Growers' Exchange, was formed and thus far has functioned successfully in marketing the rapidly increasing crop. This exchange was fostered by the association, and in 1927 the name was changed to "Calavo Growers of California."

That the avocado has come to stay as an important crop in California is now reasonably assured. The food value of the fruit itself and its potentially high return per acre are sufficient reasons to justify its place in California horticulture. The present planted acreage in California consists of about 2,500 acres in bearing and 5,000 in non-bearing trees.

Botanical Descriptions.—The avocado belongs to the genus Persea, a member of the Laurel family, to which belong also such economic plants as camphor, sassafras and cinnamon. There are two distinct species, *Persea americana* and *Persea drymifolia;* the former includes all varieties horticulturally grouped in the West Indian and Guatemalan races; the latter includes the small fruited varieties of the Mexican highlands, which are grouped into the Mexican race. Of these three races, two only are of commercial importance in California—the Mexican and the Guatemalan. Popenoe has classified these races as follows:—

1. Leaves anise-scented; skin of fruit thin (rarely more than 1-32 inch in thickness): *Persea drymifolia*—Mexican race.
2. Leaves not anise-scented; skin of fruit thicker (from 1-32 to ¼ inch in thickness): *Persea americana.*
   - (a) Fruit summer and autumn ripening; skin usually not more than 1-16 inch thick, leathery in texture—West Indian race.
   - (b) Fruit winter and spring ripening; skin 1-16 to ¼ inch thick, woody in texture—Guatemalan race.

Early Avocado Plantings in South Africa.—There are no official records with regard to the first introduction of avocados into South Africa. There are, however, some very old and large West Indian seedling avocado trees to be found along the Natal coast and in the Transvaal low veld, which shows that avocados have been grown in South Africa for many years. In Durban there is a particularly fine old West Indian seedling avocado orchard which produces good crops and testifies to the suitability of this area for avocado

growing. The fruits, however, when tested were found to be much inferior in flavour, quality and oil content to the improved Mexican and Guatemalan varieties and hybrids of these two races.

Until quite recently the avocado trees in South Africa consisted almost entirely of budded and seedling West Indian varieties. Needless to say the planting of seedling trees led to many disappointments owing to the long time they take to come into bearing, taking from seven to ten years before they bear. On the other hand, budded Mexican and Guatemalan varieties on Mexican stock have borne fair crops at three years of age and good crops at four years of age in South Africa. The West Indian race is the most susceptible to cold of the three races, and this has likewise been a decided drawback.

It is most important for South African growers to know that the West Indian race is unsuited climatically to California conditions, as evidenced by the failure of the plantings made in the past, and may be disregarded as far as its economic importance is concerned in California. Whilst the chief reason for this failure is its susceptibility to cold, its inferior quality also has something to do with its unpopularity.

If the avocado industry in the Union of South Africa and the Rhodesias is to take its rightful place, we must get away from the seedling and West Indian variety stage, and plant only budded trees of the Mexican and Guatemalan varieties and hybrids of these two races on Mexican stock. As far as we know at present the Mexican stock is the best to use; at some future date it might be proved that for some varieties at least the Guatemalan stock should be used. In California the Mexican stock is the one preferred, and since avocado trees on this stock in South Africa have made remarkable growth, there is no reason to suspect that for South African conditions the Mexican stock might not be the best.

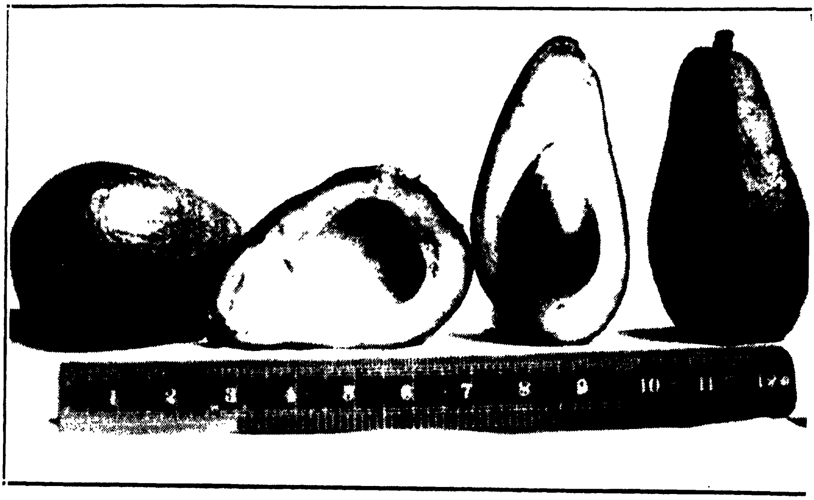
History of Mexican and Guatemalan Varieties in South Africa.—In 1925 the Department of Agriculture presented imported budded avocado trees to three nurseries in the Transvaal low veld. Three varieties were presented to the

Alkmaar Nurseries, Alkmaar, Eastern Transvaal, namely, Gottfried, Itzamna and Collinson. The Gottfried has grown taller than the other two varieties, and one can only marvel at such remarkable growth at such an age. This is not all. In addition to the remarkable growth, the trees had a fair crop at three years of age, and a good crop at four years of age. This is almost unheard of in South African avocado circles, and all who see these remarkable trees become avocado enthusiasts at once. The flavour and quality of the fruit are excellent, and a great improvement on the usual West Indian avocado one comes across in South Africa.

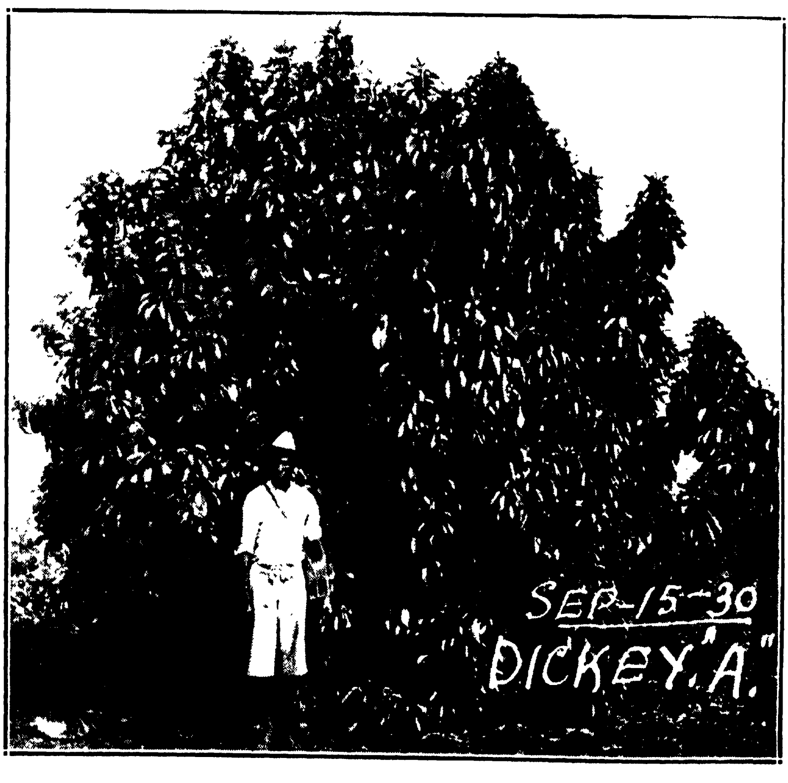
At this stage (1925) the writer, having seen the wonderful avocado orchards in California, was instrumental in impressing on Mr. Ludman, the manager of the Alkmaar Nurseries, the value of the budded avocado of the Mexican and Guatemalan varieties, and in getting him to import other varieties and Mexican seeds for stocks from California, and to go in for the avocado nursery business in a proper and businesslike way. Fortunately Mr. Ludman soon became an ardent avocado enthusiast, and in 1926 imported from California six other varieties, namely: Fuerte, Mayapan, Linda, Spinks, Ward and Dickey A. These six varieties have grown very well at Alkmaar, and have fruited for the past two years, and at present, four years after planting, have a very good crop. They are almost as big as the trees planted more than a year before them, and truly are a remarkable sight. Avocado trees in general, if left unpruned, adopt a very pleasing shape and enhance the beauty of a garden.

These nine varieties have formed the basis of the new avocado industry in South Africa, and have been used by the Alkmaar Avocado and Citrus Nurseries (as the nurseries are now named) as parent trees.

Varieties Recommended for the Union and Rhodesia.—The Fuerte is the outstanding variety, and is the only one that can be recommended for commercial planting in California. The Fuerte has done well in South Africa and should form about 50 per cent. of any commercial planting to-day. The balance should be made up of Nabal, Puebla, Taft, Queen, Mayapan, Dickinson and Anaheim, as being



Fruit of the Fuerte avocado.



Young avocado tree grown on Alkmaar Estates.

the next best. It is not necessary to plant all seven varieties, but the choice should be made from them. At present, however, only the Mayapan can be purchased, and of the remaining six varieties the Taft and Queen will not be available for some time, as they have just been ordered. In view of the present difficulty of obtaining all of the eight varieties at this stage, it would be advisable to include Itzamna in the commercial planting, since this variety is gaining rapidly in popularity and is available at present.

The avocado enthusiast has now nine varieties which he can purchase, and in view of the fact that these varieties are now being offered in large quantities for the first time in South Africa it might be advisable in many cases to give at least every variety a trial. For home gardens this should certainly be done, because it will ensure fruit almost the whole year round. In every instance the fruit will be found to be far superior to the average West Indian variety found on the markets.

The Fuerte and Puebla were the two outstanding hardy varieties that emerged from the severe cold wave of 1922 in California with comparatively little injury. Growers who are not in an absolutely frost-free area should, therefore, plant these two varieties to make certain, and try one or two of the Guatemalan varieties as well. By an absolutely frost-free area is meant an area where damaging frosts do not occur. The damage of frost to the leaves is usually very slight, because the tree can soon overcome this. But when limbs are frozen back the position becomes serious. In general it can be said that the Mexican varieties will thrive where the orange thrives, and the Guatemalan varieties where the lemon thrives. This means that the avocado can be grown in a very wide area in the Union of South Africa and Northern and Southern Rhodesia.

Six varieties of avocado have been specially recommended in California as being the most resistant to cold, namely: Fuerte, Puebla, Duke, Blake, Northrop and Topa Topa. Of these six varieties, four are now growing at Alkmaar, and the Duke and Blake have been ordered, so that South African growers can have a wide choice of varieties that are resistant to cold.

The following summary, made by Dr. H. J. Webber after the winter of 1916-17 in California, gives in general re-actions of the tree to the different degrees of low temperature experienced. It will be noticed that the Mexican race can stand a great deal of cold.

30° F.—Nothing injured as far as could be observed.

29° F.—No injury of account; only traces on most tender growth of West Indian and Guatemalan varieties.

28° F.—New foliage scorched on Guatemalan type; West Indian varieties showing considerable foliage damage.

27° F.—Mexican varieties showed new tips slightly scorched; Guatemalans showed almost all new foliage injured; West Indians badly damaged.

25° to 26° F.—Mexican varieties showed new foliage injured, but some dormant trees uninjured; all Guatemalan sorts showed new foliage badly injured and some old foliage scorched.

24° F.—Some dormant Mexican varieties injured; Guatemalan varieties badly injured, small limbs frozen back.

21° F.—All Guatemalans killed to bud; a few of the hardiest Mexican varieties, such as Knowles and San Sebastian, with young leaves only injured.

The principal climatic factor limiting the culture of the avocado is low winter temperatures, and the relative importance of low winter temperatures is concerned primarily with their frequency of occurrence, the degree of temperature reached, and the duration of injurious temperatures.

There are, however, many growers of other fruits who would very much like to plant avocados even if there appears to be some risk from the point of view of low winter temperatures. Such growers would naturally not want to go in for avocados on a commercial scale if there is some danger of frost damage. They would be perfectly justified in planting a few of the hardier varieties, and if unsuccessful the loss would be slight. On the other hand, many farmers are now in a position to plant a few avocados in

the home garden in areas which formerly were deemed too cold for the West Indian varieties. The dietetic value of the avocado is so high that growers should persevere in growing the avocado even in areas where success is problematical as judged by former standards with regard to the suitability of an area for avocado growing.

Dietetic Value.—As far as protein, minerals and fat are concerned the avocado stands at the head of the list, and with reference to carbohydrates contains fully 50 per cent. of that found in fresh fruits. These facts alone would warrant the conclusion that the avocado unquestionably contains nutritive values far exceeding those of other fresh fruits.

The dietetic value of fruits, aside from the actual nutrients they contain, lies in their succulency, minerals, vitamins and organic acids, and judged from all points of view, therefore, the avocado possesses unusually high nutritive and dietetic value.

Importation of Cattle from Overseas: Contagious Abortion.

It is hereby notified that in future all cattle imported from overseas must, before leaving the country of origin, be submitted to a serological test for contagious abortion and declared free therefrom by a qualified veterinary surgeon.

CHAS. K. BRAIN,
Director of Agriculture.

13th February, 1931.

New Strains of Oats for Southern Rhodesia.

By H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

The value of the oat crop as fodder for live stock is universally recognised, and many varieties have been introduced into this Colony from Europe, Australia and America with a view to obtaining strains suitable for cultivation during the period of the summer rains. The only successful introductions, however, have been the "Burt" and "Kherson" varieties, or strains derived from them, and even within these groups the majority appear to become more susceptible to attack by rust after being grown here for a few years.

In the course of numerous variety trials it was found sometimes that a few plants withstood the disease better than the remainder of the crop, and about six years ago the work of isolating these strains was assigned to the writer, with a view to establishing types which would possess superior powers of resisting the rusts which had hitherto caused the crop to be unreliable.

A second oat now known as Kinvarra—belonging to the "Burt" group—was about that time being grown with some success by a local farmer, and this was brought to the notice of the Department. This oat proved to consist of several different strains, which varied considerably in habit of growth, colour, shape of seed, etc. About 200 of these strains have been isolated and their behaviour observed; many exhibited hybrid characteristics, but several fairly pure lines were established. Though there are slight differences in the period these require to reach maturity, they all ripen within about ten days of one another and are

more or less subject to attack by stem rusts, which in some seasons destroy a large part of the crop. This weakness has rendered the selective work with this variety difficult, for attack by rust is not of uniform intensity over the whole of the plots, and thus the same strain may be badly attacked or only slightly affected, according to the position in the field it chances to occupy. Although all these strains are found to be subject to rust, about half a dozen which appear superior to the others have been segregated. These are being subjected to further tests, after which the best will be propagated and distributed.

In spite of the fact that Kinvarra oats have proved very susceptible to rust on this station, satisfactory results are often obtained with it at other centres; and though in such instances rust appears, it seems to take a less virulent form.

Kinvarra oats mature more quickly than any of the other summer varieties, and under normal conditions require about 120 days fully to mature. Hot and dry weather causes earlier ripening, and conversely cold and wet weather lengthens the period required. When grown for green fodder or hay, the summer crop may be cut as early as fifty days after the date of sowing, but a considerably heavier crop will be obtained if it is allowed to continue its growth for a further period of three to four weeks. When this variety is sown in April for a winter crop it requires 140 to 150 days to reach maturity unless ripening is hastened by curtailing the water supply. A July sown crop usually ripens prematurely in little more than 100 days, owing to the extremely hot and dry weather experienced in September and October, and such late sowings cannot be recommended.

The optimum date for seeding the summer crop is from late in December to the middle of January, but sowings may continue until the end of January if the crop is required for hay.

Sown broadcast, about 60 lbs. of seed is required per acre and about 45 lbs. per acre when sown with the drill.

Kherson Oats.—This variety was first introduced by the Chief Agriculturist in 1913 as a result of a tour through the United States of America. Since that time several importations have been made, both by this Department and by

local seed merchants, and each importation appears to have brought forth a somewhat different strain. Selected strains —namely, States Pride, Albion, Richland, Nebraska, Wisconsin N 7, Sixty Day N 47 and Minnesota—have been received from the Department of Agriculture of the United States. These have been included in our trials, together with some 250 other strains derived from selected plants grown here of the previously imported strains, gathered from various sources. On the whole these have given more promising results than the Kinvarra selections. In wet seasons the leaves sometimes become infected with rust, but the stem is usually only slightly attacked, and little damage is sustained if the crop is required for hay. Although the seed crop may be somewhat reduced when the leaves are severely attacked, in the more promising selections the loss from this cause has not so far exceeded 25 per cent.

These strains require from two to three weeks longer to reach maturity than the Kinvarras, and the best time for sowing for grain is from the middle of December to the end of that month; but for fodder only, the sowing period may usually extend until the end of January.

On fertile land these oats will yield two to two and a half tons of hay per acre, or up to 1,000 lbs. of grain per acre. Owing to the comparatively small size of the grain, a smaller quantity of seed is required per acre, and 40 lbs. or even less will be found sufficient if the seed bed has been well prepared.

Among the imported strains, that named Nebraska has proved the best suited to local climatic conditions, but its yields of both grain and fodder have been exceeded by several of our own selections. Seed of the most promising of these has been sent to the Gwebi Farm and to the Research Farm, Marandellas, for further trial and multiplication.

Though rather small, the grain of Kherson oats, when the crop is grown under favourable conditions, is fairly plump, and the chemical analyses given later indicate that in nutritive constituents it compares well with oats grown in other countries.

Hull-less Oats.—A third series of oat selections is represented by the hull-less strains. These arose through the accidental hybridisation of the imported "Liberty" hull-less oat with some of the Kherson and Kinvarra selections, which were grown on adjoining plots. Several hundreds of these hybrids have been tested and the least promising eliminated, until at the present time about a dozen remain for further trial. Two of these, known respectively as HC 1 and HA 14, have been multiplied sufficiently for small quantities to be distributed to farmers and to the Gwebi Farm. They will probably prove to be slightly less rust-resistant than the best Kherson strains, but under the conditions at this station they have proved considerably hardier than the Kinvarras and better suited for summer cultivation. They resemble their Kherson parents in disease resistance and habit of growth, but the seed panicles are similar to those of the wild hull-less oat (*Avena nuda*), which are characterised by their multiple-flowered spikelets and naked hull-less kernels.

The chief distinguishing feature between the strains HA 14 and HC 1 is that the culms of the former are taller and coarser than those of the latter; but while the individual culms of HC 1 are finer and shorter, they are produced in greater numbers, so that the total yield of fodder and grain is about the same for both. Owing to the fineness of its straw, the HC 1 may be preferred by stock feeders. On fertile soil HA 14 reaches a height of five feet or over, and a local farmer reports having reaped considerably over ten tons of green fodder per acre. In one or two cases the yield of grain when this variety has been grown during the winter months has been disappointing. The reason for this is not clearly understood, but it is thought that it may be due to excessively heavy dressings of nitrogenous manure or to too little water during that critical stage—the flowering period, or to a combination of these causes.

An indication of the rapidity with which these oats can be propagated is afforded by an instance in which a local farmer was supplied with half a pound of seed of HC 1; this yielded 90 lbs. of grain for re-sowing, and the resulting crop has given 30 bags of seed for sale, in addition to sufficient for sowing a much larger acreage on the farm.

The highest grain yield obtained so far from hull-less oats was reaped on this station last season, when 835 lbs. of grain and 1,340 lbs. of straw were grown on half an acre. This production was on land which had been heavily manured the previous season for potatoes. On soils of average fertility, yields of 800 to 1,000 lbs. per acre of grain should be expected.

Neither of these strains is as yet quite pure in respect to the hull-less character, a very small percentage of covered grain being produced. Further selective work is in progress, by which it is hoped to eliminate this slight impurity.

These oats require about the same period for growth as the Kherson variety, and the heaviest grain crops are obtained when the seed is sown before the end of December. Sowing may continue until the end of January if the production of fodder is the chief objective, but even then earlier sowings usually produce the heaviest crops.

Owing to the small size of the kernels, 20 lbs. to 25 lbs. of grain is sufficient to sow an acre.

I am indebted to the Chief Chemist and his staff for the chemical analyses given in the tabulation below. These show that hull-less oats have a very much higher protein content than any of the others and that they occupy a unique position among the cereal grains. They have a higher nutritive value than the famous Sussex oats, and it is believed they will prove a valuable feed for all classes of young live stock and for poultry. In collaboration with the Poultry Branch, arrangements were made to test whether this hull-less grain could safely be fed to poultry, and a pen of four young birds was fed exclusively on it for a period of one month. At the conclusion of the trial these fowls appeared healthy and had gained in weight, so it may be assumed that no harmful effects are likely to arise from feeding these oats to poultry or other stock. The use of the hull-less oat for conversion into meal for calf and pig feed, and even perhaps for the local production of an appetising breakfast food, are possibilities which are not to be ignored, but before the latter goal is attained it will be necessary to produce a variety which is entirely

free from hulled grain. "Liberty" oat satisfies this requirement, but is suitable in this Colony only for winter sowing.

S.E.S. Oats.—"Burt" oats were introduced in 1913 with Kherson, but were not found so suitable as a summer crop, and were therefore not grown extensively. In 1926 a few pounds of this oat were received from a farmer in the Bromley district, who stated that he had grown it satisfactorily as a summer crop on his farm. In trial plots here, however, a very large proportion of the plants succumbed to rust, but a small percentage continued their normal growth and matured. The more promising of these were kept, and subsequent tests have shown that some of them are likely to prove valuable. They are all very robust, and on fertile soil grow to a height of over five feet. These strains require a comparatively long season to reach maturity, and may with advantage be sown in November or early December to be ready for reaping during the following April or May. When sown as early as this it will be advisable to sow in drills to facilitate weeding, unless land which is comparatively weed-free is available.

These S.E.S. selections include some of the most rust and drought-resistant strains we have; besides which, they are very heavy croppers, producing under favourable conditions up to three tons of hay or 1,500 lbs. of seed per acre. They thus repay the long growing period they require. Owing to their ability to resist drought and frost, they are well adapted for sowing in January and February as "catch" crops under maize when the stand has become reduced through insect pests, heavy rains, etc. When sown late in this way on land which retains moisture, they provide valuable green fodder during June and July at a time of the year when such food is usually scarce.

Some of these strains continue to produce new tillers over a period of some months if the semi-mature growth is removed at frequent intervals, and although this characteristic causes uneven ripening of the grain, it is believed that it may prove useful to poultry men who require a daily supply of succulent fodder. In a trial made here in which the green fodder was removed at intervals of two to four weeks, seven separate cuttings each about 12 inches high were taken, as well as a final crop of seed.

When it is proposed to use the crop in this manner, fertile land which can be irrigated should be chosen, and the seed should be sown about two months before the first cutting will be required. In order to induce the continuous formation of side-shoots, the culms should be cut when the seed heads appear or before that stage is reached, but they should not be cut so low as to injure the young shoots which are to form the next crop. The best height for cutting will depend on how the fodder is to be made use of, e.g., when luscious material is required it may be obtained by cutting at eight to ten inches from the ground at frequent intervals, but in other cases it may be preferable to secure heavier cuttings, though fewer in number, by mowing somewhat closer to the ground. If it is desired to obtain a frequent succession of crops, very low cutting should be avoided.

It was mentioned above that a crop of seed was secured after seven cuttings of green fodder had been taken. In general practice such treatment cannot be recommended if the green fodder is grown for winter use, for it was found that after the last cutting fully two months elapsed before the seed reached maturity, by which time the seasonal rains made harvesting difficult. It is thought, therefore, that seed can more economically be produced from a summer grown crop, but luxuriant cuts of green fodder can be produced all the year round if successive sowings are made and artificial supplies of water are available when needed.

This strain tillers freely, and 25 to 30 lbs. of seed per acre will usually be found sufficient.

The chemical analyses of the grain of S.E.S. and Kherson oats given below show that although they are slightly more fibrous than English oats, their protein content is much higher.

CHEMICAL ANALYSES OF OATS AND OTHER GRAIN.

	‡Kherson Oats	‡S.E.S. Oats, Selection No. 42	‡Kinvarra Oats	‡Hull-less Oats, Selection No. H.C. 1 (Winter Crop)	‡Hull-less Oats, Selection No. H.A. 14 (Summer Crop)	‡Munga or N'youti	‡Maize, Salisbury White	†Wheat	†American Oats	*English Oats
Moisture % ...	9.51	10.09	9.66	10.47	10.36	9.40	10.15	10.2	9.2	13.0
Ash % ...	3.90	3.36	3.92	2.42	2.08	2.18	1.22	1.9	3.5	...
Crude Protein %	15.31	15.31	12.25	18.10	17.60	11.37	8.90	12.4	12.4	10.0
Ether Extract %	5.32	5.76	8.70	6.95	7.75	4.31	4.52	2 1	4.4	5.0
Fibre %... ...	11.26	13.48	13.71	1.52	1.69	1.57	1.90	2.2	10.9	10.0
Carbohydrates %	54.70	52.00	51.76	60.54	60.52	71.15	73.24	71.2	59.6	58.0
Nutritive Ratio	1 : 5.1	1 : 5.1	1 : 7.0	1 : 4.3	1 : 4.5	1 : 7.2	1 : 9.4	1 : 6.1	1 : 6.5	1 : 8.0

References: ‡ Chemical Branch : Department of Agriculture, Southern Rhodesia.
† Feeds and Feeding, by Henry and Morrison.
* Agriculture, by Watson and Moore.

The above tabulation shows the chemical composition of the grain of the new oat selections referred to in these notes, and includes that of other well known cereals for comparison. It will be noted that (with the exception of Kinvarra) the protein content of the new oats is markedly superior to that of the other cereals and to American or English grown oats.

The heaviest crops of oats on this station have been grown on land which has been liberally dressed with farm manure, applied either direct or to the previous crop. With the possible exception of instances where excessive dressings of nitrogen have been given, oats on highly fertile land are found here to be much less subject to attack by rust than on poor or exhausted land. Under the latter conditions the plants seem to lack the necessary vigour to enable them to withstand disease, and judging from our results, the crop cannot be recommended for land which is too poor to produce eight to ten bags of maize per acre.

Oats as a Rotation Crop.—Plates Nos. 1 and 2 illustrate crop rotation trials on the Salisbury Experiment Station.

The upper illustration shows an unthrifty crop, which is the result of growing maize only, alternating with bare fallow since 1913. During recent years the yield has not exceeded six bags per acre per two-year period.

The lower illustration depicts the maize crop in a three-course rotation also commenced in 1913. The order of rotation is: beans for seed (vines ploughed under), oats and maize. In this case the maize yield during recent years has averaged nearly 12 bags an acre for a three-year period, in addition to the oats and beans. No manure or fertiliser has ever been applied to the plots, and the results would seem to indicate that apart from the beneficial effect of the bean crop, the oats have made a smaller demand on the fertility of the soil than the maize.

"Is the Conservation of Soil Moisture Essential?"

The following letter from "Hartley Farmer" and the comments of the Chief Agriculturist and the Acting Chief Tobacco Adviser are published as items of general interest.

I was rather surprised at the Chief Agriculturist's note on "E. G.'s" article in the December number of the *Rhodesia Agricultural Journal* advocating the harrowing and compacting of old land after ploughing. In the first place, one would require an extra span of cattle for the job, nothing but a heavy roller having any effect on the boulder-like clods. A roller is an expensive implement, and judging by the number of idle ones they do not appear to be very popular among our farmers. Now, after getting the land broken up and compacted, say it gets a few showers in September and October; a number of weeds come up—those weeds are rather difficult to kill by harrowing on a smooth, compact surface. Finally, by the 20th November you get two inches of heavy rain. What is the result? A baked, hard surface, with difficulty in covering your seed when you put the planters on. Personally, if I harrowed and compacted my old ground on contact soil after ploughing and I got two inches of rain on it as I got this year in October, I would just have to plough the whole thing over again. I strive to keep my lands as loose as possible till the first planting rains come. I then push on five light broad harrows in front of the planters (they will easily do their 100 acres a day) and I harrow it across again after the planters, making a seed bed all that one could wish for. Anyone who has sat on a planter for nearly 20 years as I have knows how nice it is to plant after the harrows, with the surface of the ground drying and a few inches mulch for a seed bed. Even though someone offered to harrow and compact my old ground after ploughing, free of all cost, I would

refuse without any hesitation. I quite agree with the Chief Agriculturist and "E. G." about new land needing a lot of breaking up. If you want a good crop on it for the first season you must get it ploughed as early as possible, December preferably, then disc and drag harrow. I always take care that the first turn of the harrow goes the way it was ploughed (as a disc plough usually leaves the furrow sitting on edge) and you bury all herbage underneath better. Harrow until there is a good mulch on top to exclude the air. Plough again about August or September, then it should be well decayed and in fine condition for planting when the rains come.

I would also like to touch on cultivation. I have grown 100 acres of tobacco annually for a number of years past. So far I have only used first and second year's land. The first year's land is ploughed (old grass all burnt) only once, but well ploughed after the first heavy rains in November or early December. I harrow it for three or four turns, and then ridge up in nice big ridges. I then put the gang over the ridges with badzas to touch it up a little, breaking down any tufts, etc. I never put a cultivator in any of my tobacco. My gang of 50 boys will go over the 100 acres in a day or so, taking out any weeds. That done about twice in the season is all the cultivation—if you call it cultivation—it gets. I put 150 lbs. of blood meal to the acre, and about the growth—Mr. Ellis saw it last year and was very much impressed. The second year's land was really too heavy, and I reckoned it would cure 1,000 to 1,200 lbs. per acre. I had no rain from the 21st December till the 16th of January. It only got .40 inch till the 20th January and it showed no ill effects whatever. When I see people going through perfectly clean land time after time with a cultivator, then it makes me think. If the humus is not there, all the cultivation in the world will not make the crop grow. When I use cultivators it is to kill weeds. From my own experience and observations now I will take some convincing that 50 cultivators (provided you keep your lands perfectly free of weeds) will add any lbs. to your tobacco crop or any bags per acre of mealies.

COMMENTS BY THE CHIEF AGRICULTURIST.

"Hartley Farmer" should appreciate the fact that advice given in this Journal is usually based on broad principles and may require modification to meet local conditions. It is not suggested that all soils should be harrowed down and compacted after winter ploughing. No good purpose would be served by such treatment of a light, sandy soil. On the other hand, where the land bakes into hard lumps after winter ploughing, it is of advantage to break these large lumps into smaller ones—not necessarily to work the land to a fine tilth—and simultaneously to compact the soil. This can be done by attaching to the plough one of the spiked rollers frequently referred to in this Journal and described at some length in the issue for September, 1929.

If a land ploughs up in large clods and if these bake hard under the winter sun, three and even more inches of rain are often required to fall before the field can be worked to a suitable seed bed for planting; but if by previous treatment these large clods have been reduced appreciably in size, less rain will be required to penetrate them, and in consequence the seed bed can be prepared earlier in the rainy season and with less exertion on the part of the oxen, which are at that time of year often in low condition. The gaining of a week in the date of planting by this means may well be a matter of supreme importance in seasons when the rains are late in breaking and when they end at an earlier date than usual.

COMMENTS BY THE ACTING CHIEF TOBACCO EXPERT.

Concerning the question of tobacco cultivation, I think the practice advocated by your correspondent is fairly general in the tobacco growing areas. In my opinion, the question of hand cultivation is very largely bound up with the use of ridges. Practically the whole of the tobacco crop is set out on broad, high ridges, which are not added to at all during the course of a season. In my opinion, this practice detracts to a large extent from the value of mechanical cultivation. It is considered in Southern Rhodesia that the primary advantages of ridging are to afford good drainage and to prevent the plant being uprooted by sudden wash

of water. In the United States, however, a very different idea prevails regarding ridging, which practice is considered excellent for the purpose of new root formation on the plant. To accomplish this object cheaply, mechanical cultivation is necessary, and the building up of the ridges is accomplished by the alternate use of the ordinary cultivator and the wing-shovel plough.

In the writer's opinion, however, it would at least be preferable to use an ordinary cultivator once or twice, as the expense attached to cultivation by hand labour would be considerably decreased. Machine cultivation makes an excellent job, and it can definitely be stated that little damage is done to the leaves and but few plants have to be re-set. Machine cultivation, however, should be continued only till such time as the leaves start to spread properly across the rows.

The Seventh Maize Export and Grading Conference.

The Maize Grading and Export Conference was held this year on the 9th December, about five weeks earlier than usual, in order that the difficulties which had been encountered might be fully discussed while they were still in the minds of those concerned.

The following attended: Messrs. D. Black and J. Buckmaster (representing the Farmers' Co-operative Society, Ltd.), Mr. E. W. T. Povall (for Wightman & Co.), Mr. N. St. Quintin (of the Rhodesia Milling & Manufacturing Co., Ltd.) and Mr. W. Rogers (for Messrs. Louis Dreyfus & Co.). The growers were represented by the Farmers' Co-operative Society delegates and by Mr. L. Noaks, M.L.A., and Mr. H. B. Christian (of the Rhodesia Agricultural Union and the Maize Association). Mr. G. L. Robertson, District Superintendent of Transportation of the Beira and Mashonaland and Rhodesia Railways, was also present, as were the

Secretary for Agriculture and Lands, the Director of Agriculture, the Chief, Division of Plant Industry, the Assistant Agriculturist, the Senior Grain Inspector and Mr. D. Hampton.

The chair was taken by the Chief, Division of Plant Industry.

Numerous matters affecting the interests of growers and exporters were discussed, the following being the more important decisions arrived at:—

Grading Staff.—A resolution was moved by Mr. St. Quintin and carried unanimously expressing appreciation of the generally satisfactory manner in which the grading staff had carried out their duties during the past very difficult season. The same speaker emphasised the need for a sufficiency of graders during the peak export months of August to October, and suggested that in future the movements of graders should be directed by the Department of Agriculture instead of by the Railways. After considerable discussion and a statement by the chairman, it was agreed that such a change would not be likely to result in any greater rapidity of movement, and, indeed, would probably have the reverse effect. It was therefore decided that control of movement should continue to be exercised by the District Superintendent of Transportation.

Representatives of the Maize Association suggested that the Department should endeavour in future to employ maize farmers of some experience as temporary graders, and this it was agreed to do, provided suitable applicants would offer themselves for these temporary engagements.

Motor Transport.—Stress was again laid on the importance of sufficient motor transport being made available for graders, particularly in view of the restricted train service on the branch lines. The Secretary, Department of Agriculture and Lands, replied that the matter would be kept in mind, and that in view of the proposed maintenance of an enlarged motor transport park by the Government, he hoped it would be found possible to provide the transport required.

Re-examination of Maize known to contain Excess of Moisture.—Attention was drawn to the great waste of

graders' time which resulted from the frequent re-examination of maize rejected on account of excessive moisture. After lengthy discussion, the meeting passed the following resolution:—

"Any maize rejected on account of containing more than 12.8 per cent. of moisture as shown by the Brown-Duvel moisture test shall not in future be re-examined by the graders for at least three weeks, unless in the meantime it has been re-stacked by the owner in accordance with regulations to be laid down."

The attention of growers is particularly called to this decision. Directions for re-stacking in such cases will appear in a later issue of the Journal.

Graders to be given a Definite Section of the Railway Line to Work as soon as Delivery becomes General.—The District Superintendent of Transportation agreed with the proposal in principle, but pointed out the difficulty of adhering to it strictly. He promised, however, that he would put it into effect as far as was found possible.

Classification of Slightly Weevily Grain adopted in Southern Rhodesia.—One delegate spoke at length on this matter. The chairman stated that under the new regulations the definitions for weevily and slightly weevily maize were quite clear and unequivocal, and informed the meeting that it was the intention of the Department to adhere strictly to the regulations.

Appeal against Graders' Decisions to an Independent Referee to be made Possible.—This subject was raised and spoken to by several delegates. The chairman explained the position and read paragraph 9 of the Produce Export Ordinance of 1921, which provides in such cases for an appeal to arbitration, the person appealing being liable for costs if judgment is given against him. It was decided that more publicity should be given to this clause in the Ordinance. The clause reads as follows:—

"Any owner of produce intended for export being dissatisfied with the decision of or action taken by an inspector under this Ordinance may appeal to the Controller against such decision or action. A further inspection shall thereupon be made by the same or another inspector. If, as the result

of such inspection, the decision or action appealed against be altered in favour of the appellant, no fees shall be charged for such inspection. If the owner is still dissatisfied with the decision or action of the inspector, he may appeal to a board to be appointed. Before the matter is referred to the board the person appealing shall deposit at the office of the Controller such a reasonable amount as, in the Controller's opinion, would be sufficient to defray the costs of the appeal. Such board shall consist of three members, of whom one shall be the Controller and at least one shall be directly interested in the kind of produce giving rise to the dispute, and its decision shall be final. The costs of the appeal shall be in the discretion of the board."

Further Tests by the Department to Ascertain the Effect of Different Methods of Harvesting on the Drying-out of the Grain.—Numerous suggestions for experiments on these lines were made. It was pointed out that although the Department might assist in this matter, it was primarily the duty of the producer to ensure that his product was in a fit condition to meet marketing requirements, and if he failed to do so he had only himself to blame. The majority of growers, owing to the care they took in harvesting, shelling and bagging, experienced no difficulty from wet maize, and if the majority could do this, the minority could equally well do so.

The chairman agreed to have carried out such trials in harvesting methods as were found possible, and it was further decided to circularise farmers who in the past have not been troubled with wet maize and to make known their experiences and advice on this matter, also that officers of the Department would address farmers' meetings on the subject of grading, give instruction in making the thumb-nail test and emphasise the trouble to all concerned which arose from the delivery to the Railways of maize containing an excess of moisture.

Irrigation Notes.

Irrigation Experiments.—The annual report of the Department of Agriculture of the Union of South Africa for the year ended June, 1930, contains much interesting information regarding irrigation experiments which are being carried out by the Department in certain localities. In Northern Natal, on an area under irrigation from the Pongola River, experiments were carried out on the effect of irrigation on the yields of maize and sugar cane. The average yield of irrigated maize was 36 bags per acre, whilst the yield of sugar cane (Uba variety) reached the high figure of 74.6 tons per acre at the age of 19 months. At Grootfontein the experiments are mainly concerned with the duty of water for lucerne and other fodder crops. Figures are being tabulated to indicate the optimum supply of water for the various crops under varying conditions. In all, 33 experiments are being carried out on lucerne and fodder crops under irrigation on a total of 660 plots. It is found that the effect of fertilising lucerne with an application of 300 lbs. of superphosphates per acre resulted in a 70-80 per cent. increase in yield.

It is hoped that experiments of a somewhat similar nature will be initiated at the Matopos School of Agriculture during the coming season.

Irrigation Development.—The past year has been an era of marked progress in the various phases of activity covered by the Irrigation Division of Southern Rhodesia. The number of visits made to farms in connection with irrigation and soil erosion protection advice is 97 in excess of the previous year's total. The number of visits on irrigation matters has totalled 168, the number of schemes favourably reported on amounting to 62 for an irrigable area of 1,917 acres; the majority of these schemes are either in course of completion or are actually constructed. The irrigation loan funds have been drawn upon to an increasing extent during the year. During the eighteen months these loan funds have been available, 42 applications for loans

have been received, of which 28 have been approved for loans totalling £5,800. Of this amount, £4,390 has been paid out to date.

The total of £5,800 is distributed as follows among the various types of works covered by the loans:—

(a) Irrigation works: £3,240 for 10 schemes totalling 270 acres.

(b) Repayment of boring charges: £2,260 for 15 farmers with 26 boreholes.

(c) Soil erosion protection works: £300 on three farms.

It is encouraging to note that instalments of interest and redemption on these loans are being paid promptly as they fall due. Eight instalments on loans became due during the last quarter of the year, and only two of these are at present overdue. As these loans are definitely allocated for reproductive works which are regarded as economically sound, the best proof that the money has been spent on sound development will be afforded by the prompt repayment of the loans.

Any marked tendency for these payments of instalments to be evaded or delayed would naturally result ultimately in a restriction or total withdrawal of the present facilities for the loan of money for development purposes on easy terms.

Soil Erosion.—Requests for advice on this matter continue to increase. The number of visits to farms on soil erosion protection works totalled 143 in 1930, as compared with 124 in the previous year. The work was more evenly distributed throughout the year, as a number of farmers put in contour ridges at the end of the wet season on lands which had been under green manure crops, and, in addition, storm drains are more easily excavated at this period than later on in the year. This is a development to be encouraged, as it lessens the demand for advice of this nature which normally occurs during August and September and enables the services of the engineers to be more efficiently utilised throughout the dry season. In this connection attention is drawn to the notice in last month's *Rhodesia Agricultural Journal* requesting farmers to put in applications for advice

early in order that as many visits as possible may be made towards the latter end of March and early in April.

It should be noted also that in accordance with a recommendation of the Maize Enquiry Committee, the regulations regarding payment for engineering advice have been amended to permit such advice being given free of charge, provided the engineer is not detained more than a day on field work and that no subsequent office work is entailed for the preparation of plans and estimates.

Boring.—A favourable feature of the work carried out by the Government drilling machines last year is the fact that there was a considerable increase in the work prepared for private applicants and that the charges per foot drilled were lower than in the previous year. In all classes of work 19,311 feet were drilled at an average cost of 20s. per foot, including the price of the casing.

As regards private applicants, 5,420 feet were drilled at the low average cost of 14s. 9d. per foot, including the price of the casing, and in all 42 boreholes were sunk for such applicants and 80 per cent. yielded useful supplies of over 2,000 gallons per diem. The average depth per borehole was 129 feet, so that on the basis of the charges levied, the average cost of a borehole to a private applicant was only £95.

During the whole period of six years that boring has been carried out by Government drilling machines, 20,614 feet have been drilled for private applicants at an over-all average cost of 17s. 9d. per foot. When it is realised that permanent deep-seated supplies of water are developed in these boreholes, and that the cost of lining them through all soft formations is included, it is evident that well sinking to tap these same permanent supplies cannot compete with this low average cost.

For the information of farmers it may be stated that drilling machines are at present available in the following districts:—Lomagundi, Salisbury, Makoni, Gwelo, Bubi, Wankie, Bulawayo and Bulalima-Mangwe. Those who are contemplating putting down boreholes should make application before the machines are shifted from these districts.

C. L. R.

The Training of Pointers and Setters.

(Continued.)

FIELD WORK.

By DUNCAN K. SMITH.

The points required in a well trained pointer or setter are: Keenness, good nose, obedience, to be staunch on point, drop to shot and wing—or remain standing after a shot is fired or game has risen, until given the signal to "carry on" —to quarter his ground regularly and with judgment, to maintain a fast and killing range, to retrieve or point dead, to be cheerful and easily handled, and not to chase or "run in" to game or shot.

Quartering means a more or less regular working of the ground from side to side and at about 30 to 40 yards in front of the handler, the beat to extend about the same distance to right and left. This distance is quite far enough for a young dog, which can be increased as the dog becomes more reliable. Some dogs will be found to quarter well naturally, while others are inclined to forge ahead; this fault should be checked as soon as possible. As soon as a dog is seen to forge ahead the trainer should change direction, which will have the effect of making the dog change direction also. As soon as the dog has quartered far enough to one side change direction again, which will again bring the dog right across. Each time the direction is changed make a sweeping motion with the hand, which the dog soon gets to understand. After several lessons the dog will change direction to the signal quite willingly.

If the dog persists in running straight ahead, turn your back on him and at a good pace retrace your steps; this has

a very steadying effect and tends to make the puppy careful to watch the handler, as a young dog does not like to find himself suddenly alone.

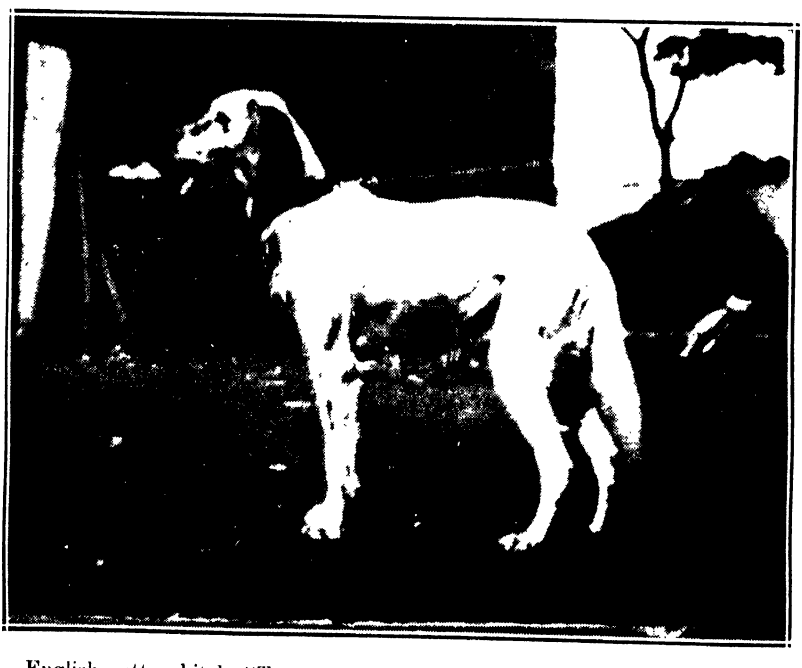
When a dog finds a scent which interests him, do not let him give up too soon. If he cannot find the game, encourage him to work the ground all around thoroughly. This will do him good, even should there prove to be no game there.

At five or six months of age most pointers and setters will have the pointing instinct well developed, and will naturally come to point on sitting game. Often a young dog will get on the scent of running birds and in his excitement flush them; this should be quietly checked, and he will soon get over the fault. Do not keep a young dog too long on point; encourage the dog to flush the game. If a young dog is unwilling to do this, the handler should walk past the pointing dog, when the game will generally rise. Persevere in your efforts to make the dog do the flushing; this can be done by gently forcing the dog towards the game, and in time he will understand and do what is required of him.

The trainer must insist on the dog either dropping or at least remaining still as soon as the game rises. Young dogs are very apt to chase the game; a sharp word of command the minute the game has moved or the shot that follows may have the effect of checking the dog. If not, he must be got in as soon as possible and shown plainly that the trainer is displeased. A few light cuts with a switch may be necessary, but do not be too heavy handed unless lighter checking is inadequate.

The writer has found that with very headstrong dogs a check line is most effective. That is, a long, light but strong line is attached to the dog's collar and allowed to trail when the dog is working; when the dog comes to point, the end of the line is securely held by an assistant, with just enough slack to allow the dog to get into his stride. The game is worked in the ordinary way by the dog and trainer; the dog will run in as usual when the game is flushed, with the result that can well be imagined. The sudden stop at the moment of temptation has a very steady-

"Ch. Redwood Flo" on point. (Owned by Mr. F. H. Jacobs, Salisbury.)



English setter bitch "Tess of Trimby." (Owned by Mr. D. K. Smith, Marandellas.)

ing effect, especially on a young dog. Repeat this several times or until the dog holds his ground after game has risen.

If a dog has been trained to drop, he should be made to drop and remain down as soon as a bird is flushed or as soon as a shot is fired. A very sharp drop at the right moment is often enough, if not "peg away" until he does so automatically. Insist on the dog dropping to any shot, whether it be fired by the trainer or another shooter.

Hares are a very great temptation to even trained dogs, and are often the cause of much trouble.

When the game has fallen dead or wounded, the dog should be kept either down if he drops or held still for several seconds before he is sent in to "retrieve" or "find dead."

If the young dog is disinclined to retrieve the game, the trainer should encourage him in every way. If the game is shaken and thrown a few yards, the dog can be interested sufficiently to pick it up at least. Gradually he will come round and retrieve willingly. The dog that is required to "point dead" instead of retrieving must be encouraged to find the dead game and remain staunch on point when it is found until the game has been picked up by the trainer.

The writer finds it more satisfactory to recover each bird as it is shot rather than work the whole covey before gathering the game, as there is less risk of losing any "runners." Working the whole covey first may be more spectacular, but collecting as you shoot is safer from the "bag" point of view.

Checking the dog from running in will be found the most difficult part of the training. Do not allow the dog to go far without supervision and on no account to follow any of the boys. The native hunting instinct is a danger, and it sometimes happens that when the "baas" is away the boys take the dog out for a glorious chase, which the dog would thoroughly enjoy and which would have the effect of undoing much of the good work of training.

It is easier to prevent a bad habit forming than to cure one when formed; therefore keep the dog "up to the scratch" always. A few hints on checking faults in trained and partly trained dogs will be given later.

Hints to Poultry Breeders.

PREPARE FOR THE BREEDING SEASON.

Issued by the POULTRY BRANCH.

Every poultry keeper naturally hopes for a good hatching season, and numbers of strong well-grown lusty chicks. This can only be accomplished by having breeding stock of the best quality possible, and in the best of health and condition.

The Housing.—This must be comfortable, airy, without draughts, scrupulously clean and convenient. A house of 6 ft. x 6 ft. is sufficient for a breeding pen up to twelve hens and a male bird; it must not be too hot nor too cold, but of as even a temperature as possible; and above all it must not be damp.

The Food must be of a good quality and plain. There must be no forcing with too much meat food; and above all condiments of any sort spell failure, i.e., in poor hatches and weak stock. Grain, well buried in the litter, should be the main item; only a little, if any, dry mash. Plenty of green succulent food and thick separated milk will keep the birds in good health and condition.

Selection of the Birds.—This must be very carefully carried out, and the sooner the better. The main points are:—Birds of standard size, type and colour and good layers of large eggs. There is an inclination at the present time in other countries (it is gratifying to know that it does not equally apply to Rhodesia) to choose breeders for their laying qualities only, and little or no attention is paid to type, size, colour, size of egg or constitution. Only the very best in every way should be selected as breeders. No bird, for

instance, which lays an egg under 2 oz. should be put in the breeding pen; in fact, we recommend birds laying $2\frac{1}{4}$ oz. eggs. These will produce pullets, if properly reared, which will lay (when they have got into their stride) nothing under 2 oz.; but if only 2 oz. eggers are used, many of the progeny will lay under 2 oz.

Number of Females to one Male.—This is a question often asked. Given the qualities necessary in the breeders, then the amount of scratching exercise the birds are made to take and the size of the run have a great bearing on the matter. A light breed male can be given more hens than a heavy breed one by three or four under similar conditions. For instance, in a run of 6 ft. x 30 ft., six to eight hens of a heavy breed are sufficient for one male. Given a run double the size, ten to twelve females can be given, and so on. If on absolute free range, twenty heavy breed birds to one male and thirty to thirty-five light breed birds are not too many. We have run fifty-two Leghorns with one male on free range, and nearly every egg has been fertile. Of course the birds must be in good hard condition and with no superfluous fat. Breeding stock on free range, if it is possible to arrange, produce, there is no doubt, better hatching and better chicks than if in confinement; but it is often difficult to do this, especially if several breeding pens are being used.

Treatment of the Breeding Stock before being Mated.—This is almost the most important factor in the production of good stock. The birds selected must be given, if possible, free range; heavy laying must not be encouraged. To put birds into the breeding pen that have been laying heavily for some time is to court disaster in poor hatching and weak chicks. The system generally and the reproductive organs must be in the best of condition; heavy laying is a big strain on these. The resultant germs, embryos and later developed chicks are naturally weak. Too often we find poultry breeders putting birds that have just come off a laying test or which have just finished their pullet year of laying with high records into the breeding pen, and then have been disappointed with the results and wondered why there has been a poor hatch and the progeny are not up to the quality of their dams. The reason is obvious; after months

of heavy laying, can one possibly expect the vitality and organs to be in a condition to produce strong, healthy progeny? It stands to reason they cannot. Two or three months, therefore, of recuperation on free range, with a rest and a more or less cessation of laying, is absolutely necessary. Never breed from birds that are in the moult or just over it; this again is a big strain on the system and organs. They should be well over it and have at least a month's rest before going into the breeding pen.

These are points the poultry keeper often misses, and the result is a poor hatching and rearing season. It is infinitely preferable to have half the number of breeding stock that are in the best of condition than double the number that are not. Poor breeding stock means waste of time, labour and money and no improvement; good breeding stock means the reverse.

Bulletins on "Choosing a Male Bird," "The Breeding Stock," "Mating for Improvement," are available, post free, on application to the Poultry Expert, Department of Agriculture, Salisbury.

Fruit Sweets.

By Miss M. Jooste, Lecturer in Home Economics, Stellenbosch-Elsenburg College of Agriculture.

There are many different ways of preserving fruit, but few South African housewives have thus far taken to storing them in the form of sweets.

All varieties of fruit can be used for the making of fruit sweets, according to the recipe given below. The quantity of sugar may vary slightly according to the acidity of the fruit; if too much sugar is used, however, the product will not set so easily.

A combination of two or three kinds of fruit gives excellent results and at the same time variety. A good combination is, for example, equal quantities of pears, apples and plums. By adding one tablespoonful of lemon juice to every 2 lbs. of pulp when the latter has been boiled until the required consistency has almost been reached, a more pronounced flavour is obtained. This additional acid will also facilitate the setting. A cup of currants, sultanas or nuts adds to the nutritive value of the product.

Instead of fresh fruit, dried fruit may be used, with the slight difference that the dried product must be washed and then soaked overnight. The next day it should be boiled up in the same water used for soaking.

These sweets can be kept for months if stored in jars or boxes with absorbing paper, e.g., blotting paper, between the layers. The container must not be quite airtight.

Recipe.—Cut the fruit from the stone or core. Boil it down to a pulp; press the pulp through a sieve of medium mesh and measure the quantity obtained. To every cup of pulp add a three-quarter cupful of sugar. When the pulp is very sour, cup for cup may be used. Cook the mixture of pulp and sugar until it begins to thicken. It should be carefully watched during boiling to prevent burning. Cool a little of the pulp on a small plate; if it sets, the mixture has reached the desired consistency. Remove the mixture from the fire, slightly grease layer pans or platters with butter, and pour the mixture into these to a depth of about one inch. Place these pans or platters in a breeze and leave for a day. Hereafter cut the paste into one inch squares, roll into granulated sugar and allow to stand in a draught (use wire cake trays if at hand) for a day or two until firm. Perhaps it may be necessary to roll them once more into sugar.

Screw Worm in Cattle.

Numerous reports have been received by the Department of Agriculture indicating that damage from screw worm in cattle has increased during recent years.

The Department has, therefore, decided to release an entomologist from other duties for a time to visit infected farms, and to endeavour to obtain information regarding the habits and life history of the insect concerned and possible means of control. The London and Rhodesian Mining and Land Company, Limited, are assisting in this work by providing transport and facilities for investigations on their ranches.

The fly causing the trouble is not known in the Union, but it is the most troublesome species in India.

Up to the present it has never been observed on farms, and the adult flies have only been seen when bred from maggots taken from wounds, and thus nothing is known concerning its feeding and breeding habits. It is not attracted to carrion, and for this reason it cannot be trapped by the means which act so satisfactorily in the case of the ordinary blow-flies.

In addition to the field observations, experiments will be carried out in fly-proof stables at the veterinary research laboratories, and in these the entomologist and the Director of Veterinary Research will collaborate.

The Director of Veterinary Research has for some years past been investigating the possibility of treating screw worm cases by means of a vaccine, and these investigations will be continued.

During last season about fifty experimental lots were tested by farmers. Only twenty-two reports have thus far been received, but the treatment from eighteen of these was remarkably effective. The definite organisms involved have never been isolated with certainty, and it may be on this account that the four failures resulted.

It has not been possible to determine whether the cases occurring in different parts of the Colony are caused by the same kind of fly, and it is felt that farmers could assist the Department in these investigations by sending living maggots taken from wounds to the Chief Entomologist, Salisbury.

These should not be sent in tin boxes or bottles, as they will not live under conditions that are too close. They should rather be packed in grass in small wooden or cardboard boxes filled sufficiently tightly to hinder undue shaking about.

Method of Collecting and Sending in Plants for Identification.

In sending plants for identification the following rules should be observed in order to facilitate determination and that good specimens may be made and kept as records in the Government Herbarium:—

1. Collect if possible three specimens of each plant.

2. Specimens should be as complete as possible and should consist of—

   (a) Trees or Shrubs.—A small leafy branch with flowers and, where possible, fruits.

   (b) Grasses and small Herbaceous Plants, including Bulbose Plants.—The whole plant, roots, leaves and flowering stem.

3. Specimens should be placed as soon as possible after gathering between sheets of newspaper cut to size about 15 x 10 inches. Any specimen larger than this (as in the case of grasses, etc.) should be bent once or twice to bring it within the compass of the paper.

4. It is advisable that specimens should be dried flat before sending by placing them with plenty of newspaper

between under a heavy weight. Where, however, immediate identification is desired, they can be sent as soon as gathered.

5. A label should be inserted with each plant bearing an identification number, where it was collected, type of soil and environment, and any information such as local name, uses, etc., that may be available. A specimen similarly numbered should be retained by the sender for reference.

6. The parcel of specimens should be placed flat between two sheets of stiff cardboard, tied tightly and addressed to "The Botanist, Department of Agriculture, Salisbury." If the letters "O.H.M.S." are placed on the parcel, it will travel free.

7. Large fruits or bulbs, etc., should be packed separately in a box and given the same number as the specimens to which they belong.

8. Succulent plants or parts of plants should be packed in a box, each plant wrapped in newspaper. *On no account should any moisture* be introduced into the packing.

For the benefit of collectors who have no botanical knowledge, it should be explained that in the construction of the flowers and fruit of a plant lies the key to its identity, at least as to family and genus, while the identification of the particular species depends often on the leaves, their arrangement on the stem, etc., and vegetative parts generally. In grasses and other herbaceous plants the nature of the root system is important.

As the plants of Southern Rhodesia become better known and the herbarium becomes more representative, it may be possible often to name a plant from somewhat incomplete material, always provided we have complete named specimens of the same plant in the herbarium with which to compare it.

Notice to Exporters of Maize.

The attention of exporters of maize is drawn to the decision of the Government to extend the period from the 31st March, 1931, to the 30th April, 1931, within which the bounty on maize exported overseas shall be paid; provided that the amount, if any, which will fall to be paid in respect of maize exported overseas in April shall not exceed £5,000 (which is equivalent to 100,000 bags at the maximum of 1s. per bag), and provided also that the following procedure is observed by applicants:—

Intending exporters must notify the undersigned not earlier than the 24th March, 1931, of the number of bags they intend exporting overseas during April.

Applications for the bounty will be dealt with in strict order of priority of application on or after the due date. No application can be considered after the £5,000 has been allocated.

A. C. BAGSHAWE,
Secretary,
Department of Agriculture and Lands.

PIGS FOR SALE.

Pedigree Large Black and Large White boars and gilts —the progeny of pigs recently imported from England—will be available for sale from the Gwebi farm from February onwards. Orders may now be booked. Prices: five guineas for animals of five months of age, and one additional guinea for each additional month of age up to a maximum of seven guineas at seven months old or more. No pedigree pigs will be sold at a younger age than five months. Prices are f.o.r. Gwebi, and crates are returnable at cost of purchaser.

Enquiries in the first instance to be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury.

Correspondence.

[*No responsibility is accepted by this Journal for the views expressed by correspondents.*]

Salisbury,
3rd February, 1931.

The Editor,
Rhodesia Agricultural Journal.

Sir,

Rhodesian Snakes: Nomenclature.

I note that in one of your editorials in the January number subscribers are invited to communicate what they know about the nomenclature and habits of Rhodesian snakes.

The Natal Rock Snake: Chishona, "Robambila" (striker of the rock rabbit); Sindebele, "Umbopo."—This snake is totally different in shape and habits from the ordinary python, in that it is extraordinarily quick in its movements when alarmed. It does not constrict its victims. Its length averages 12 feet and its circumference at the thickest part rarely exceeds 7½ inches. The males are blue-black and the females a greyish-brown. I have never seen any with red wattles. It is usually found in granite kopjes, and preys chiefly upon the rock rabbit and on the young of owls and other birds having their habitat among the rocks and crags.

The phantom snake of the Transvaal and Orange Free State—the much-feared "dassie-slang," said by the old Boers to be a snake with a big, hairy head—owes its name probably to the fact that one or two of these snakes were seen in the act of swallowing a "dassie" with the forepart of the animal protruding.

The bite of the rock snake is venomous and often fatal, as the writer had frequent occasion to treat natives bitten by them. The natives know of a very efficacious herbal antidote to the poison.

Banded Cobra.—In some parts the Chishona name is "nyamafungu."

Python.—Chishona, "shatu"; Central Africa, "sato."

I am, etc.,

H. CLIFFORD FYNN.

Farming Calendar.

March.

BEE-KEEPING.

As the latter end of this month should herald the approach of the second and last real honey flow of the season, see that enough extra supers are ready for placing on hives as required, watching also that the fully drawn out combs of shallow frames that are on hand to fill them with are kept free from the wax moth; further, examine all supers that are already on the hives for this serious defect, though strong colonies will as a rule keep the combs free from this pest. March being usually a hot month, look well to the entrance; enlarge when and where necessary, and have ventilating lids on the tops of each hive. Extra ventilation can be provided for when required by placing small metal or wooden wedges underneath the top super, but not to be open enough to let out or in a single bee. Where quilts are noticed to have been eaten or more or less destroyed during the summer months, now is the time to make fresh ones so as to be ready for the closing down and the making snug of each hive when winter approaches; old flour bags or old deck chair canvas make capital quilts. Bees during this month will consume a quantity of water; see that some is always kept in the apiary in floating cork chips. This will save much labour and flight for them, as well as prolong their period of work and usefulness. As stated in last month's notes, flying swarms may be expected now any day, so prepare for their capture if required by having all details and items ready for immediate use. It is as well, however, at this date of the season to do without such swarms, unless the owner is prepared to feed them well during the winter months. March or April swarms, unless they are hived under conditions of providing all the frames, of fully drawn out old combs, do not as a rule have either the time or materials to provide for a strong colony before the winter sets in, and must perforce remain a weak one during that period. The axiom of every bee-keeper should be to let his colonies go into winter quarters brimming over with bees, not only to provide against the mortality that is bound to occur then, but to have a full hive to start the next season with.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until latter end of April.

CROPS.

Watch oats for rust, and, if badly infested, cut crop for hay as soon as weather permits. Ridge late potatoes, and if weather is dry prevent ridges from cracking, to check tuber moth infestation. Finish ploughing under all green manure crops while the ground is still moist enough to promote rapid decomposition. Late in the month begin to cut silage crops and ensile. Cut out barren maize plants and feed to stock or ensile. Cut Sudan grass for hay to permit of final late growth for autumn grazing. Reap any crops that are ready, and plough the stubbles **at once.** Lift ground nuts that are sufficiently matured. Watch for ground nuts making second growth; reap, and when sufficiently dry, place in cocks with nuts inwards and cover the top securely. Sow onion seed beds for winter crop. Watch the weather for hay-making and take advantage of fine spells. Towards the end of the month hay-making should normally be in full swing. Continue to plough all lands in succession immediately the crops are reaped from them. Vleis and irrigable lands should now be ready, or in process of being prepared, for winter crops. Early sowings of Algerian oats, barley or rye for green forage can be made. Allow any potatoes lifted to dry before storing them, but do not leave too long in the sun. Destroy witch weed and other noxious weeds. Continue to make all the kraal manure possible by throwing grass and litter into kraals, yards, etc. Begin to select in the field maize plants for seed purposes, and mark them with slips of coloured cloth. Press on with the breaking up of any virgin land which may have been stumped or cleared earlier in the year. Place orders for grain bags without delay. Early in the month silage pits should be cleaned out or, where necessary, new pits dug.

DAIRYING.

This is usually the most favourable month of the year for dairy operations. Cooler nights are now in evidence, and there is usually little difficulty in maintaining a low temperature in the dairy and cheese-room. If elementary precautions are taken, all cream should be first grade, and first-class cheese should be made, as a gassy condition of the milk is rare. Dairy cows, unless they are very high producers, can go without extra rations, because the grass is now in seed and grazing is ample. The cheese storeroom is generally full of cheese, and care should be taken to turn the cheese regularly. The windows and doors should be opened at night and closed in the daytime. A little mould on the cheese will not affect its quality, but if the mould is excessive the cheese should be rubbed daily.

Calves which are under four months old should be kept in and allowed to nibble at well-got hay; at the same time a little dry mealie meal and monkey nut cake will do them good and teach them to eat concentrates. An ample supply of clean water should be provided in the calf run.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood may now be found in the stalks, but nothing can be done at this stage. Caterpillars sometimes attack the crop as a sequel to cultivation after grass weeds have made too much growth. The caterpillars attack the crop on account of their more natural food being suddenly destroyed. Prevention and not cure is indicated.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but leaf miners and budworms may be in evidence. The latter are usually destroyed by hand when topping. Any plants affected with stem borer should be removed and destroyed.

Potato.—If ladybird beetles or caterpillars are injurious, spray with arsenate of lead (powder) 1 lb. to 30 gallons of water. Careful hilling should be attended to with the object of preventing and checking tuber moth attack.

Vegetable Garden.—If sawfly attacks plants of the cabbage family dust with Paris green 1 lb., fine sifted slaked lime 20 lbs. Against cabbage louse (aphis) wash plants frequently with a strong spray of water. Destroy blister beetles by hand. Plants of the melon family may be baited regularly with arsenate of lead (powder) 1½ ozs., treacle ½ gallon (or cheapest sugar 2½ lbs.), water 4 gallons, to keep down fruit flies. For leaf-eating caterpillars and beetles, etc., spray with arsenate of lead (powder) 1 lb. in 30 gallons of water on foliage which will retain water. Cabbages are best dusted.

Citrus Trees.—Collect and destroy infested fruit to keep down citrus codling. Fruit-piercing moths sometimes attack the fruit during the month, especially navels. They work at night and can only be dealt with at present by hand destruction. The trees should be watched for development of aphis and soft brown scale on the young growth and prompt measures taken. Resin wash at two-thirds standard strength is suitable.

Mosquitoes, House Flies, etc., may be very prevalent during March. Destroy breeding places. Poison or trap adult flies. Attend to screening of residence.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbage and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains cease entirely it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

FORESTRY.

Cultivation where necessary should be undertaken between the rows of trees planted out in previous months. If cultivation is carried out with the hoe, care should be taken not to pile earth round the base of the stems. New ground for next season's planting should be roughly broken up with the plough. Bulk plantings may be proceeded with during the month.

GENERAL.

At this time the condition of stock on the veld is usually good. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding pens should have all been mated up by now, as the first chicks should be out by the beginning of April. Much more care should be used than is usually the case when selecting birds for breeding. Only the very best, i.e., the strong, healthy, vigorous ones from the best layers,

should be chosen. A pamphlet on "Selection and Mating for Improvement" can be obtained on application to the Editor or the Poultry Experts. This deals fully with the subject. Always keep an eye on the male bird; many are apt to get thin and run down in health, due to their allowing their mates to eat all the food. Such birds are better breeders than those that chase their mates away from the food. Every male that is being bred from should be given a good meal by himself each day, to ensure health and vigour. The incubator should be thoroughly overhauled, cleaned and disinfected before the eggs are put in.

STOCK.

Cattle.—The precautions recommended for February apply equally to March. Arrangements should be completed for storing as much silage as it is proposed to make, so that the crops reserved for this purpose may be harvested immediately they are ready.

Sheep.—The same precautions as for February should be taken, but as less rain may be expected, conditions will probably be more favourable. If late winter lambs are not desired, the rams should be removed from the flock.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed. Tobacco bulks should be examined and turned, if necessary.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

April.

BEE-KEEPING.

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction,

but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS.

During the first half of this month, autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands; irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 to 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence

farmers invariably have trouble in producng first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid

gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial control. The spray must hit the insect to kill. Do not re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growth may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possible. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Experts, Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early

and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable gratis from the Poultry Experts.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

Southern Rhodesia Veterinary Report.

December, 1930.

ANTHRAX.

Infection was manifested on three farms in the Mazoe district and on the Mtoko Native Reserve. The total mortality was 11 head of cattle. All in-contacts were vaccinated.

A Persian ram imported from the Union died at Sandown Station a few minutes after being off-loaded.

TRYPANOSOMIASIS.

One case in the Melsetter district.

HORSE-SICKNESS.

One death in Wankie district.

CUTANEOUS MYIASIS (SCREW WORM IN CATTLE).

Cases reported from five districts.

PIROPLASMOSIS (REDWATER).

A serious infection occurred in the Salisbury district amongst a herd of cattle removed from one farm to another; about 22 head died.

IMPORTATIONS.

From the Union of South Africa: Bulls, 18; heifers, 27; horses, 4; donkeys, 16; sheep, 2,531. From Bechuanaland: Sheep, 203; goats, 68.

EXPORTATIONS (CATTLE).

To the Union of South Africa: For local consumption, 85. To Belgian Congo: Slaughter, 1,733. To Northern Rhodesia: Slaughter, 328.

EXPORTATIONS (MISCELLANEOUS).

To the Union of South Africa: Pigs, 89. To Northern Rhodesia: Pigs, 138; sheep, 193. To Belgian Congo: Pigs, 44; sheep, 107; goats, 10. To Bechuanaland Protectorate: Horse, 1.

EXPORTATIONS IN COLD STORAGE.

Carcases: Beef, 380¾; sheep, 85; pigs, 14. Livers, 208; tongues, 218; hearts, 141; brains, 89; tails, 363; tripes, 373; heads, 17; plucks, 20; feet, 8; cheeks, 149; kidneys, 68.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

JANUARY, 1931.

Pressure.—The mean barometric pressure was generally above normal. On the 1st a trough of low pressure extended to the south-east coast; this withdrew on the 2nd and extended to the south on the 3rd, then swung to the south-east coast and withdrew on the 5th. A tongue extended to the south-west coast on the 6th and remained there until the 10th, when a southerly low appeared on the south coast, and was on the south-east coast on the 11th. On the 13th a high appeared on the south coast and moved inland, while the equatorial low extended to the south coast on the 14th and swung, showing a weak trough, to the south-east coast on the 15th. It extended to the south-west on the 16th, leaving a weak trough on the east coast, which deepened on the 17th and extended into Southern Rhodesia on the 18th,

when a high appeared on the south coast. On the 19th the high moved in, and pressure fell from the north on the 20th and 21st. A marked fall from the north appeared on the 25th, and a high appeared on the south coast on the 26th and advanced up the coast on the 27th and 28th.

Rain Periods.—Scattered showers fell on the 1st and 2nd and 3rd, with isolated showers on the 4th. From the 5th to 7th showers were numerous in the north and east, falling to scattered showers on the 8th and 9th and isolated showers on the 10th. Showers were fairly general in the north-east from the 11th to the 14th, and extended over the whole area on the 15th and cleared in the south-east on the 16th. Showers were numerous on the 17th and 19th and fairly general on the 18th. On the 20th fairly general rain occurred in the north and east, with scattered showers elsewhere, becoming general on the 21st. Showers were fairly general, except in the south-west, from the 22nd to the 26th, and were numerous on the 27th. From the 28th to 30th isolated showers only occurred, followed by fairly general showers in the centre and south-west on the 31st.

Rainfall for January.—The mean rainfall over the country amounted to 4.3 inches, compared with the average of 7.2 inches. The seasonal total is 15.9 inches, which is normal. The distribution was as follows:—

	January, 1931.	Average January.
Zone A	4.1	6.4
Zone B	1.7	5.7
Zone C	5.6	7.6
Zone D	6.5	8.3
Zone E	4.0	8.0
Zone F	11.3	12.5

The deficiency is very marked in Zones B and E, both of which lie to the south. This may be attributed to the unusual amount of easterly wind in this area.

JANUARY, 1931.

Station.	Altitude	Pressure 8 a.m.	Temperature ° F.						Humidity, 8 a.m.		Precipitation.		
			Absolute.		Mean.			Diff. from Normal.	Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min.						
Bulawayo ...	4,440	867.3	90.0	56.1	81.3	61.5	71.4	...	63.3	74	4.07	−1.7	5
Gwelo	4,632	861.5	86.0	54.0	80.4	60.2	70.3	...	62.8	76	2.07	−4.0	10
Riverbank ...	4,100	...	94.0	57.0	87.3	62.4	74.8	...	65.9	69	2.78	−3.6	12
Essexvale ...	3,828	...	95.0	59.0	84.7	63.7	74.2	...	...	...	3.62	−2.8	7
Gwanda ...	3,235	902.5	94.0	59.0	84.5	63.5	74.0	...	65.5	72	.35	−5.4	1
Mazunga ...	1,970	...	...	...	...	...	...	...	...	...	...	...	...
Nuanetsi ...	1,630	...	97.0	...	86.2	...	...	...	...	...	.99	...	6
Between Rivers	3,970	...	...	...	...	...	...	...	...	...	...	...	...
Enkeldoorn ...	4,720	...	83.0	54.0	80.2	59.9	70.0	...	63.5	73	2.87	−4.5	7
Gatooma ...	3,850	...	91.0	59.0	85.0	62.3	73.6	...	66.7	72	4.04	−3.5	14
Miami	4,090	...	...	...	...	...	...	...	...	...	...	...	...
Salisbury ...	4,865	853 7	85.0	55.0	78.3	61.1	69.7	...	63.5	74	8.82	+2.5	22
Sinoia Citrus ...	3,830	...	85.0	55.0	81.1	62.4	71.5	...	66.6	73	9.79	...	14
Sipolilo... ...	3,900	...	85.0	60.0	82.1	63.4	72.7	...	66.2	77	6.61	−2.3	15
Juliasdale ...	6,070	...	75.5	49.0	70.5	55.0	63.0	...	60.1	84	10.20	−1.3	21
Mtoko	4,210	...	...	...	...	...	...	...	...	...	...	...	...
Shamva ...	3,170	...	...	...	...	...	...	...	...	...	...	...	...
Angus Ranch ...	2,300	...	97.0	62.0	86.5	68.8	77.0	...	70.5	74	2.08	−3.9	8
Craigendoran ...	3,000	...	93.0	60.0	87.6	63.3	75 4	...	67.37	73	6.46	−2.1	14
New Year's Gift	2,700	...	91.5	59.2	82.5	64.0	73.2	...	67.8	77	3.51	...	13
Nyamasanga ...	5,080	...	83.0	51.0	77.3	56.8	67.0	...	63.4	80	6.70	...	16
Riverdene North	3,700	...	91.0	56.0	83.0	62.0	72.5	...	66.1	80	1.52	−6.0	13
Stapleford ...	5,450	...	78.0	50.0	70.5	56.1	63.3	...	60.2	89	20.00	+2.2	29
Umtali	3,677	891.6	87.0	57.0	79.6	62.5	71.1	...	65.5	82	6.82	−1.6	19
Victoria ...	3,570	894.7	89.0	55.0	80.5	62.0	70.8	...	65.9	73	2.64	−3.9	6
Melsetter ...	5,060	850.0	79.0	52.0	74.2	57.5	65.8	...	62.8	78	10.76	−1.0	16
Mount Selinda...	3,520	...	90.0	50.0	75.0	60.9	68.0	...	65.4	81	10.64	−5.3	16

Export of Cattle from Southern Rhodesia, 1931.

Month	Union		England.	Congo		N. Rhodesia.		Portuguese East Africa.		Total
	Slaughter		Slaughter	Slaughter	Breeding	Slaughter	Breeding	Slaughter	Breeding	
	Union of S.A.	I.C.S. for overseas	On hoof							
January ...	120	...	...	1,381	1,383	626	267	..	...	3,777
February ...										
March ...										
April ...										
May ...										
June ...										
July ...										
August ...										
September ...										
October ...										
November ...										
December ...										

Notes from the "Gazette."

"Gazette" Date.	*Items.*
16.1.31.	Government Notice No. 29 of 16th January, 1931, contains regulations governing engineering and soil erosion advice to farmers. This notice cancels Government Notice No. 348 of 1929. The only change is that, in consequence of a recommendation by the Maize Enquiry Committee, engineering advice in connection with soil erosion protection works and minor irrigation schemes which would not occupy an engineer more than a day in the field, with no subsequent office work, is to be given free of charge. Formerly a nominal charge of 30s. was made for this service.
	TOBACCO CONTROL BOARD.
20.2.31.	Government Notice No. 76 contains regulations dealing with the term of office and the nomination and election of members of the Tobacco Control Board.
	GAME AND FISH PRESERVATION ACT, 1929.
20.2.31.	The setting of springs, gins, traps, snares or any other contrivances for the capture or destruction of game on any land without the consent of the owner or occupier thereof is prohibited. (G.N. 96.)

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only. Outside Southern Rhodesia, 3d. per copy.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 581. Leguminous Crops for Stock and Soil Improvement in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 591. Maize Export Conference Proceedings.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 601. Maize for Export, by S. D. Timson.
No. 603. The Production of Maize in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 684. Warning to Maize Growers: Maize for Export.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

Botanical Specimens for Identification.

Accelerating the Sprouting of Potatoes.

Further Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron, Cotton Specialist.

REPORTS ON CROP EXPERIMENTS.

No. 94. Second Report on Experiments, by J. H. Hampton.

No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.

No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.

No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.

No. 239. Reports on Crop Experiments, Gwebi, 1915-16, Part I., by E. A. Nobbs, Ph.D., B.Sc.

No. 246. Report on Crop Experiments, Gwebi Farm, Season 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.

No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.

No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.

No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.

No. 342. Rotation Experiments, 1913-19, by H. G. Mundy, F.L.S., and J. A. T. Walters, B.A.

No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-20.

No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.

No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.

No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.

No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.

No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.

No. 437. Annual Report of Crop Experiments, Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.

No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.

No. 485. Annual Report of Experiments, 1922-23, Agricultural Experiment Station, Salisbury, by J. A. T. Walters, B.A.

No. 486. Bulawayo Experiment Station, Annual Report for Season 1922-23, by H. G. Mundy, F.L.S.

No. 514. Bulawayo Experiment Station Report, 1923-24, by H. G. Mundy, F.L.S.

No. 519. Annual Report of Experiments, 1923-24, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.

No. 537. Crop Rotations on the Gwebi Experiment Farm, 1923-24, by H. G. Mundy, Dip.Agric., F.L.S.

No. 564. A Maize Rotation Experiment, by A. R. Morkel.

No. 566. Bulawayo Experiment Station, Annual Report for Year 1924-25, by H. G. Mundy, Dip.Agric., F.L.S.

No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.

No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.

No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.
No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.
No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.
No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
No. 767. Gwelo Municipal Demonstration Stations. Annual Report for the Season 1928-29, by D. E. McLoughlin.
No. 773. Bulawayo Municipal Demonstration Station: Report for the Seasons 1927-28 and 1928-29, by D. E. McLoughlin, Assistant Agriculturist.
No. 789. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, 1928-29, by H. C. Arnold, Manager.
No. 800. Bulawayo Municipal Experiment Station: Report for the Season 1929-30, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 806. Gwebi Demonstration Farm, by the Chief Agriculturist.
No. 810. Gwelo Municipal Demonstration Station: Annual Report, 1929-30, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

TOBACCO.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
No. 607. Tobacco Seed Beds, by D. D. Brown.
No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.
No. 617. Dark Fire-cured Tobacco, by E. M. Matthews, B.Sc., Tobacco Adviser. Fire-curing Tobacco Barn, by the Tobacco Advisers.
No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
No. 679. Tobacco Culture in Southern Rhodesia: The Harvesting and Curing of Virginia Tobacco, by D. D. Brown.
No. 689. The Lesser Tobacco Wireworms, by Rupert W. Jack, F.E.S.
No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.
No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.
No. 734. Common Faults in Curing Virginia Bright Tobacco, by D. D. Brown, Tobacco and Cotton Expert.
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No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.

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No. 779. Mycological Notes—Further Experiments on the Control of White Mould (Erysiphe Cichoracearum DC.) of Tobacco, 1927-28, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.

No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.

STATISTICS.

No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.

No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.

No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.

No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.

No. 247. Statistical Returns of Crops Grown by Europeans in Southern Rhodesia for the Season 1915-16, by E. A. Nobbs, Ph.D., B.Sc., and Fred Eyles, F.L.S.

No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.

No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.

No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.

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No. 361. Statistics of Live Stock and Animal Produce for the Year 1919, by F. Eyles, F.L.S.

No. 380. Statistics of Crops Grown by Europeans in Southern Rhodesia, 1919-20, by H. C. K. Fynn.

No. 393. Statistics of Live Stock and Animal Produce for 1920, by H. C. K. Fynn.

No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1920-21, by H. C. K. Fynn.

No. 426. Statistics of Live Stock and Animal Products for the Year 1921, by H. C. K. Fynn.

No. 484. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1922-23, by A. Borradaile Bell.

No. 527. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1923-24, by A. Borradaile Bell.

No. 543. Statistics of Live Stock and Animal Products for the Year 1924, by A. Borradaile Bell.

No. 580. Statistics of Summer Crops Grown by Europeans in Southern Rhodesia for the Season 1924-25, by A. Borradaile Bell, Statistician.

No. 595. Statistics of Live Stock and Animal Products for the Year 1925, by A. Borradaile Bell, Statistician.

No. 626. Statistics of Summer Crops Grown by Europeans in Southern Rhodesia for the Season 1925-26, by A. Borradaile Bell, Statistician.

LIVE STOCK.

DAIRYING.

No. 717. Gouda or Sweet Milk Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

No. 730. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.

No. 752. Cheese as an Article of Diet, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

No. 785. Bacon Curing on the Farm, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.

No. 792. The Feeding of Dairy Stock in Southern Rhodesia, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.

No. 799. The Objects of Ripening Cream for Butter-Making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.

Points to be observed in Cream Production.

VETERINARY.

No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.

No. 536. Inoculation of Cattle against Redwater and Gall Sickness, by Ll. E. W. Bevan, M.R.C.V.S.

No. 570. The Spaying of Bovines, by G. C. Hooper Sharpe, M.C., M.R.C.V.S., and M. H. Kingcome, M.R.C.V.S.

No. 597. Suspected Poisoning of Stock: The Proper Procedure, by M. H. Kingcome, M.R.C.V.S. (Lond.), and A. W. Facer, B.A. (Oxon.), A.I.C.

No. 618. Notes from the Veterinary Laboratory: Quarter Evil, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

No. 642. The Laboratory Diagnosis of Animal Diseases, by Ll. E. W. Bevan, M.R.C.V.S.

No. 666. Notes from the Veterinary Laboratory: Præmonitus—Præmunitus, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

No. 678. Cattle Transport Areas.

No. 723. A Method of Inoculating Cattle against Trypanosomiasis, by Ll. E. W. Bevan, M.R.C.V.S.

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Services of Government Veterinary Surgeons.

The Campaign against African Coast Fever, by Ll. E. W. Bevan, M.R.C.V.S.

Parasitic Gastritis of Cattle, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

IRRIGATION.

No. 270. Odzani River Irrigation Scheme, by W. M. Watt.

No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.

No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 529. The Umtali River Irrigation Scheme, by C. P. Robinson, B.Sc.

No. 632. Domestic Water Supplies and Sanitation on the Farm, by P. H. Haviland, B.Sc. (Eng.).

No. 633. The Cost of Pumping for Irrigation, by R. H. Roberts, B.Sc. (Eng.).

No. 640. Levelling for Irrigation, by Dr. W. S. H. Cleghorne, M.I.Mech.E.

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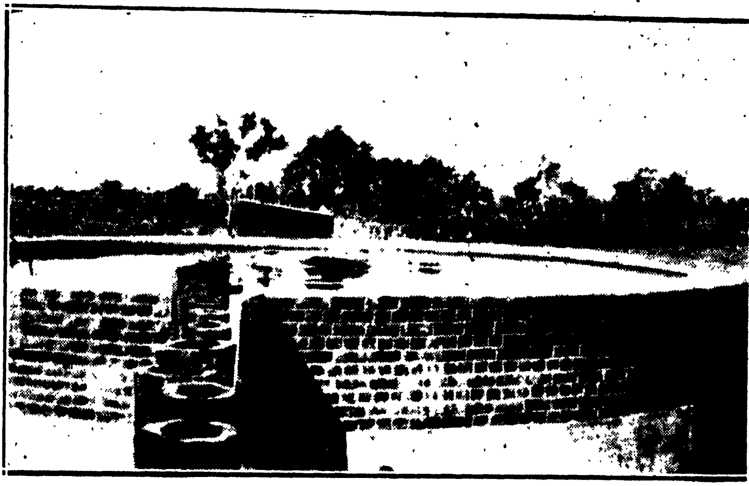
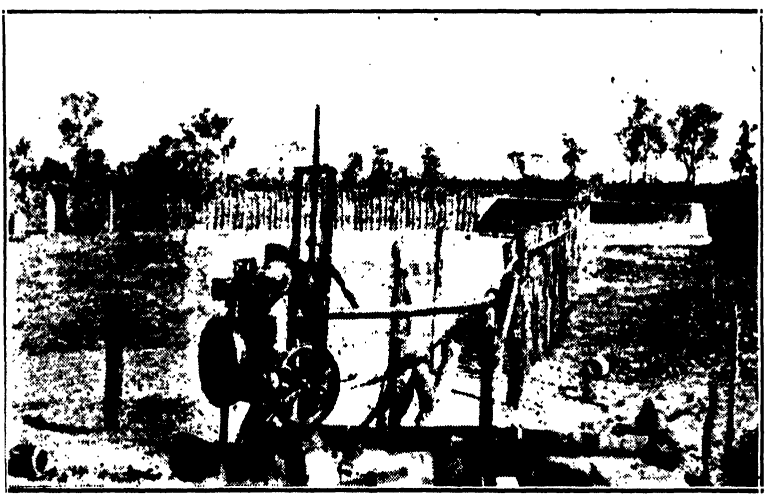


Reservoir at Nuanetsi Ranch surrounded by a circular trough on which four paddocks are centred, each running 300 head of cattle.



Same reservoir as above, showing pumping installation and paddock divisions, where the animals are controlled by an enclosure which prevents cattle returning to the grazing when required for dipping.

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

The Nuanetsi Ranch.—This ranch, of which two photographs are reproduced on the opposite page, is the property of the Rhodesian Land, Cattle and Ranching Corporation, Ltd. It is situated mid-way between Fort Victoria and Messina and is 2,750,000 acres in extent, on which are run approximately 90,000 head of cattle. Of these, 30,000 are cows and 1,500 are bulls, the balance being dry stock. The breeds favoured are Herefords and Shorthorns. Approximately 10,000 cattle are sold annually, of which 60 per cent. are exported overseas, while 40 per cent. go to Johannesburg. There are 2,000 acres under maize and ensilage crops, and excellent results are being obtained from the areas under lucerne, which are irrigated from the Lundi and Nuanetsi Rivers. The staff consists of thirty-five Europeans and approximately 1,500 natives. The manager is Mr. C. R. Dreyer.

World's Grain Exhibition and Conference.—This exhibition and conference, which is to be held at Regina, Canada, from 25th July to 6th August, 1932, is the outcome of a desire to bring together world authorities on agriculture, particularly those interested in field crops, and further to bring into open competition grain and other seeds produced in different parts of the world. The Government of Canada has invited all countries to participate, and competitive classes have been provided for cereals, grasses, clovers and vegetable seeds. The prize list is generous and in some classes allows for as many as fifty prizes. In the maize section, of which there are five classes, each of 10 ears, prizes to the value of 19,000 dollars are offered, the first prize in three classes being worth 5,000 dollars.

The conference is of particular importance to the producers of crops and research workers the world over. The greatest and best known experts from all countries will be gathered together for the purpose of giving their experiences and leading discussion. The good that may accrue from such a gathering cannot be over-estimated.

All applications for entry must be made on forms provided for this purpose and mailed to the Secretary, World's Grain Exhibition and Conference, Regina, Canada.

Proposed Cattle Levy.—The Government of this Colony has decided to provide £25,000 for the payment of a bounty on the overseas export of beef for the coming year. The bounty will be paid on meat exported from 1st January, 1931.

This decision of the Government is contingent upon the passing of a Bill, which will be introduced in the present session, authorising a levy of 2s. 6d. per head on all cattle slaughtered for local consumption and on all cattle exported from Southern Rhodesia, except such cattle as are exported overseas, either on the hoof or as frozen meat.

The levy will thus be paid on all slaughter cattle, and on all cattle exported to the Union or to the markets of the north.

It is estimated that the net receipts of the levy, after the costs of collection have been deducted, will amount to about

£15,000, which means that the cattle-breeders are putting up £15,000 and the Government £10,000.

The Levy Act, if it is passed, will remain in operation for only two years. If it is not re-enacted, it will lapse at the end of that time. This course has been deemed advisable, since there has been no opportunity to discuss the matter with the farming community. The Bill is, therefore, an emergency measure, providing a levy which will take the place of the cattle bounty which lapsed at the end of last year. During the two years it was in operation, the cattle bounty cost the country about £45,000.

China's Tobacco Import Trade.—In view of the fact that China as a possible market for Rhodesian tobacco has been the subject of a special investigation by an envoy from this Colony, it may be of interest to know that a new Chinese tariff schedule came into operation as from 1st January, 1931. From such information as we have been able to gather, it appears that although the new tariff is designed to foster domestic industry, the imports of leaf tobacco will not be seriously affected by the revised schedule, which provides for both increases and decreases in the existing rates of duty. Increased rates apply to the more expensive types, while decreased duties have been applied to the cheaper grades. The collection of import duties in China has now been placed on a gold basis.

An average taken over the period 1925-29 shows that the United States of America has furnished on an average more than 90 per cent. of China's leaf tobacco imports; 73 per cent. of the cigarette imports; 22 per cent. of the smoking tobacco imports; and 2 per cent. of the cigar imports.

In the leaf trade United States tobacco has met some competition from Japan and Hong Kong; and the United Kingdom, together with Hong Kong and Canada, show an expanding competition in the Chinese cigarette market. The total imports of leaf tobacco into China during the five-year period averaged 104,548,000 lbs. annually; and the total cigarette imports averaged 7,337,945,000 in number.

The Friesland Cattle Breeders' Association of South Africa.—The interim report of this association—which has a fairly strong membership in Southern Rhodesia—strikes an optimistic note in so far as the Friesland cattle industry of South Africa is concerned. It states that there is a good demand for first-class breeding stock and that the demand for high-class Friesland dairy cows exceeds the supply. Members are urged to be careful and strict in the culling and selection of their herds. In times of low milk prices, it is more important than ever to cull out the low producer and to breed only from the best. We learn that the membership of the association is steadily increasing, although a great number of members were taken from the members' roll as not being active. The number of registrations and transfers for the six months commencing 1st July, 1930, to 31st December, 1930, are: Registration, 1,727; transfers, 822. Compared with the last figures for the same period, this is an increase in registrations and a decrease in transfers. The decrease in transfers is mostly due to the fact that only a small number of Frieslands were entered for the last November sale.

Rhodesia and the Belgian Congo continue to import Friesland cattle from the Union, while an influx of new blood from Holland still continues. It is stated that some of the best young bulls in Holland have been purchased lately on behalf of South African breeders, while one bull was imported from the United States of America.

The herd of Messrs. A. A. Kingwill and Sons put up the best average record of milk and butter fat over all breeds in 1930, while a two-year-old of Mr. G. D. Irwin put up a South African record of 16,875 lbs. milk and 530 lbs. butter fat in 300 days.

South African Egg Export Trade.—Some idea of the rapid growth of this trade in recent years is gained from a perusal of figures published recently by the Department of Agriculture in the Union. In 1914, the total export amounted to 1,927 cases (30 dozen eggs); in 1919, when export was resumed after the war, the figure was 16,180 cases and has risen yearly until a record was constituted last

season with 192,601 cases, representing an increase of 39 per cent. over the total of the previous year. Of the eggs exported in 1930-31, the United Kingdom took 191,259 cases, Canada 1,125 cases and the Continent of Europe 217 cases. In addition, 500 cases (each of approximately 90 lb. net) liquid eggs were exported to Canada and 61 to the Continent of Europe.

Southern Rhodesia participated in this trade last year to the extent of 59,940 cases, all of which went to Great Britain. The net return to the exporters was not quite 9d. per dozen, which, considering all things, is by no means unsatisfactory. There is practically an unlimited market in the United Kingdom at a price; whether that price is sufficient to justify participation in the trade depends upon cost of production and the expense of transporting eggs to this distant market. It is something to know that Rhodesian eggs were marketed in a satisfactory condition and found a ready sale. Whole-hearted co-operative effort is called for in an undertaking of this nature; it is essential that poultry farmers should close their ranks, and if export to this market is found to be a feasible proposition, to give it their undivided support.

It is paradoxical to note, from the trade returns of the Colony for the first nine months of 1930, that while we exported very considerable quantities of eggs, we also imported eggs to the value of £7,679. It would be interesting to learn the reason for this.

Our Food Supply.—The trade returns of the Colony for the first nine months of 1930 show that during the period in question we paid away no less a sum than £280,000 for foodstuffs which should be supplied from local sources.

It is a matter for very serious consideration to find that we paid to the fruit growers of the Union £41,324 and to the producer overseas £5,043, while at the same time we know that fruit in this Colony is rotting on the ground. Perhaps the newly formed Producers' Direct Supply Co-operative Co., Ltd., will remedy this state of affairs—we hope so. Then for imported bacon we paid away £17,458. This appears to be a totally unnecessary item, for Rhodesian bacon is as a

rule superior to the bacon sent here from the south, and is as cheap, if not cheaper. If householders would insist on having Rhodesian bacon, imports would soon diminish, and farmers here could dispose of their pigs more readily. In view of the progress which the dairying industry has made in the past few years, it is surprising to find that we imported butter and cheese to the value of £14,727. Potatoes and onions to the value of £12,556 is an item which requires a good deal of explaining away, even allowing for a certain amount of dumping. Our bill of £79,021 for imported wheat and flour shows the urgent necessity for the breeding of a rust-resistant summer wheat which will possess the requisite milling qualities. Work on this problem is in progress at the Marandellas Research Station, and it is to be hoped that the plant breeder will succeed in his important task.

Scrutiny of the trade returns, a copy of which can be obtained from the Printing and Stationery Department, Salisbury, for 5s., shows that we have at our doors a market which should and must be the preserve of the Rhodesian producer. How this is to be attained is for the producers to determine, and we commend the matter to the very serious consideration of all concerned.

The World Cotton Situation.—We have received from the United States Department of Agriculture a publication (No. 104) which contains a great deal of authoritative information relative to certain phases of the cotton situation during recent years and discusses the outlook for 1931-32.

It is stated that the small consumption of cotton in 1929-30 as compared with recent years left a world carry-over of American cotton on 1st August, 1930, about 1,800,000 bales greater than on the same date of the previous year. This carry-over, added to the current crop, gives a world supply of American cotton for the 1930-31 season of about 20,700,000 bales, which is 1,400,000 bales greater than for 1930 and 300,000 bales greater than the annual average supply for the five-year period 1925 to 1929. It should be remembered, however, that the relatively large supplies during this five-year period occurred when consumption was at record levels. Yields during the past two years have been held in check by drought, although serious weevil damage has not been widespread and weevil numbers at present are

low in most of the belt. It is shown that cotton prices have declined more than the average of all commodities.

World consumption of all cottons in 1929-30 fell 4 per cent. below that of 1928-29, the reduction being equivalent to about 700,000 American bales. The consumption of Indian and sundries cotton, however, was higher in 1928-29 by about 1,100,000 bales of equivalent weight. Consumption of Egyptian cotton fell slightly.

Reduction in the total world consumption came almost entirely in American cotton. World consumption of American cotton in 1929-30 amounted to 13,023,000 running bales, compared with 15,076,000 bales in 1928-29, 15,407,000 in 1927-28, and the record consumption of 15,780,000 in 1925-26. Of the 2,000,000 bales by which the world consumption of American cotton was lower in 1929-30, approximately one half of the reduction occurred in the United States and the other half in Europe. Consumption of American cotton declined 436,000 bales in Great Britain; approximately 100,000 bales each in Germany, France and Russia; 81,000 bales in Italy, and 56,000 bales in Czechoslovakia. On the whole, Europe used more Indian and sundries cotton and less American and Egyptian cottons. Asiatic countries consumed as much American cotton as they did in the previous season, but their increase in consumption was of Indian and sundries cotton.

World stocks of cottons, other than American, did not show much change on 1st August, 1930, as compared with a year earlier. Cotton plantings in India up to 1st October, 1930, are officially reported about equal to those of 1929. The Egyptian acreage in 1930, according to official reports, was increased 13 per cent. Russian cotton acreage has been increasing rapidly during recent years, in accordance with a long-time developmental programme, and production in 1930 was estimated at about 1,950,000 bales, compared with 1,351,000 bales in 1929 and a previous record production of 1,512,000 bales officially reported in 1915.

Marked expansion in cotton acreage has taken place in the United States since the World War. For the five years 1925-29, the average number of acres of cotton harvested annually in the United States was 44,882,000 acres, compared with 34,022,000 for the five years immediately following the World War. In 1926 the acreage harvested was 47,087,000—the largest in history. The area for harvest on 1st November, 1930, was 44,791,000 acres.

Preliminary List of the more common Grasses of Southern Rhodesia.

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The following list is the result of a preliminary survey of the botanical composition of some of the grazing areas of Southern Rhodesia in connection with pasture investigation. Since these investigations are still more or less in their infancy, the list must necessarily be very incomplete, and will require to be amplified later when our knowledge of the grasses becomes more comprehensive.

The true grasses form a very large Natural Order or Family widely distributed throughout the world.

There are, roughly, about 4,000 species of grasses in the world—over 1,600 of these are recorded from Africa, and it has yet to be established how many of these African species are to be found in Southern Rhodesia.

The various species are grouped together into tribes according to their relationship one to another, and although the relationship is judged according to the construction of the reproductive or flowering organs of the plant, it often happens that those that are related botanically also bear an economic relation to each other.

The more important tribes that are largely represented in Rhodesia are:—

1. Andropogoneæ, consisting mostly of tall coarse grasses, the spikelets often in pairs, one sessile and awned, the other on a short, slender stalk, the awned spikelet being seed-bearing and the stalked one usually sterile. The spikelets are usually arranged in short or long spikes, which again are often in pairs and subtended by a narrowly inrolled or broadly boat-shaped yellowish- to reddish-brown

spathe or bract. (See Plate I., Nos. 17 and 21, and Plate II., Nos. 5, 9 and 10.)

To this tribe belong the *Andropogons*, *Cymbopogons*, *Hyparrhenias* (Tambookie and Thatching grasses), *Themeda* (Rooi grass), *Hemarthria* (Swamp couch), *Heteropogon* (Spear grass), *Ischæmum* (Turf grass), *Sorghums*, etc.

A few of the *Andropogoneæ* make useful grazing grasses, but the majority are coarse and unpalatable to stock.

The *Cymbopogons* are known as aromatic grasses and are of little value as stock feed. One species (not recorded as indigenous to tropical Africa) is the source of Citronella oil; another species fairly common in Southern Rhodesia, *Cymbopogon excavatus*, is known as Turpentine grass and is seldom grazed by stock. It has a strong smell and hot, "turpentiny" taste when chewed.

The *Hyparrhenias* form a large section of the *Andropogoneæ*; the species vary from the comparatively slender-stemmed *Hyparrhenia hirta* and *Hyparrhenia filipendula* to the tall, coarse Tambookie grasses. They are generally known as thatching grasses, being used chiefly for that purpose.

Certain species have been tested for paper making, and the reports have in most cases been very favourable, but the collecting and exporting of the grass for that purpose would not be a payable proposition.

A few of the species make useful grazing grasses before they become too coarse. One of the common Rhodesian species, *Hyparrhenia rufa*, is also reported from South America, where it is known as Jaragua grass and is said to be one of the most useful grazing grasses of Brazil.

Heteropogon contortus (Spear grass) has been the cause of much damage to the hide industry. The "seed" of this grass has a very stiff, sharply-pointed base (see Plate I., fig. 16), which pierces the hide of animals, often setting up inflammation and ruining the hide for commercial purposes.

Hermarthria fasciculata (Swamp couch) and *Ischæmum glaucostachyum* (Turf grass) are two of the *Andropogoneæ* that are excellent pasture grasses.

The various species of *Sorghum* that have been brought under cultivation are well known. Sudan grass (*Sorghum sudanense*) makes good hay and ensilage. *Sorghum caffrorum*, Kaffir corn, is, of course, cultivated for its seeds.

Sorghum halepense (Johnson grass) is a tropical perennial that does not appear to be very common in Rhodesia. It resembles Sudan grass, but is a perennial with long stout underground stolons by means of which, as well as by its free seeding habit, it spreads very rapidly and obtains a firm hold of the land. It prefers rather rich and cultivated soils.

In the United States, where this grass was introduced some years ago as a forage crop, it became such a menace to agriculturists that the importation of Johnson grass seed was forbidden and the plant was proclaimed a noxious weed under the Act.

2. Paniceæ.—This tribe includes what are known as the "bread grasses" (Latin *panis*—bread).

The spikelets are usually small, roundish or oblong, sharply pointed or blunt and without an awn or occasionally with a short straight bristle. The forms of inflorescence are various. The spikelets can be borne on fine stalks on a widely spreading panicle as in *Panicum maximum* (Guinea grass) or *Panicum novemnerve* (see Plate II., fig. 8), or crowded into dense spikes as in the case of Rhodesian Timothy grasses, *Setaria* sp. (see Plate II., fig. 3) or packed closely in one-sided slender spikes as in the Finger grasses (Plate II., fig. 2) or in one, two or three rows on short one-sided "spikes" on a common axis (Plate II., fig. 4). They are sometimes flattened on the face, but rarely compressed from the sides (see *Rhynchelytrum*).

The leaves of many of the species are flat and succulent and this tribe includes more palatable and nutritious grasses than any other. To it belong the *Panicums*, *Digitarias*, *Setarias*, *Rhynchelytrums*, *Urochloas*, *Echinochloas*, *Brachiarias*, *Paspalums*, *Pennisetums*, etc.

Panicum maximum is the well-known Guinea grass. *Panicum miliaceum*, "Proso" or "Millet grass," was cultivated for its seed, which was used in making bread thousands of years ago; now the seed is mostly used as bird seed.

Setaria italica, "Foxtail millet," "Boer manna," etc., in all its forms and varieties has been cultivated for over a hundred years.

The *Digitarias* are the Finger grasses, of which *Digitaria Pentzii*, the "Woolly finger grass," is the best known and has been proved, in the Union of South Africa, to be of such outstanding value as a pasture grass for dry lands.

The *Rhynchelytrums* include various species of the red top grasses. *Rhynchelytrum roseum*, Natal red top, though not cultivated in this country, is considered by the Americans to be a useful hay grass, and its seed has been imported into certain parts of the United States for that purpose. *Echinochloa crus-galli* is the Japanese millet or barnyard millet grass.

In the genus *Pennisetum* are included such widely different grasses as Napier grass (*Pennisetum purpureum*) and Kikuyu grass (*Pennisetum clandestinum*).

The *Brachiarias* are what are known in Southern Rhodesia as "False paspalums," and the true *Paspalums* are too well known to need comment.

3. Stipeæ.—This tribe includes in tropical Africa only three genera, and of these only one, *Aristida*, is of importance on account of its many and widely distributed species.

The *Aristidas* are known as "Steek" grasses and are easily recognised by their three-branched awns (Plate I., fig. 18) and the often sharply pointed, long hairy base to the "seed."

It is these "seeds" that cause so much discomfort to pedestrians in the veld or on old lands at seeding time and that are often responsible for mechanical injury to stock and for damage to hides.

The *Aristidas* possess little or no feeding value.

4. Eragrosteæ.—Of the several genera of this tribe only one, *Eragrostis*, need be specially mentioned.

The *Eragrostis* are known as the "Love grasses," and there are more species in this genus than in any other in tropical Africa.

The spikelets are characterised by bearing from three to many seeds in each, the glumes or scales which enclose the

seed being usually closely packed and overlapping each other (Plate I., figs. 6, 7, 8), and quite without awns or bristles. Many of the species are at present nameless and must remain so until the genus has been revised; all are of very little value to stock.

5. Chlorideæ.—The spikelets of this tribe are usually compressed from the sides, and have often several glumes, only the lower of which are seed-bearing, the upper usually being reduced and sterile. The glumes are often much flattened and more or less boat-shaped with a distinct keel, as in *Eleusine indica* (see Plate I., No. 12); some species are without awn or bristle and others bear short or long always straight awns or bristles from the tips.

The spikelets are variously arranged, but are usually crowded in more or less slender one-sided "spikes" springing from the tip of the flowering stems, as in *Chloris gayana*, Rhodes grass, and *Eleusine indica*, "Wild Rapoko grass."

The leaves are flat, fairly broad and succulent and the sheaths and stems are often very much compressed at the base and arranged fan-wise, as in *Eustachys paspaloides*, "red Rhodes grass" and Rapoko grass.

The principal genera included in this tribe are *Michrochloa*, *Craspidorhachis*, *Cynodon*, *Chloris*, *Eustachys*, *Eleusine*, *Dactyloctenium*, *Crossotropis*, etc.

The *Cynodons* are the Couch grasses. *Cynodon dactylon*, the common couch, is a cosmopolitan grass, found in practically every country of the world. It is the "Bermuda" grass of America and the "Dub" or "Doub" grass of India; in Europe it is known as "Chiendent." It is a very variable species and in the Union (perhaps also in Rhodesia) it crosses readily with the indigenous species, the Hairy Couch (*Cynodon hirsutus*), producing such hybrids as Bradley grass and Germiston grass, which are so popular for lawns.

Chloris gayana, Rhodes grass, has been cultivated as a pasture grass in Australia, India and the United States as well as in Africa—in fact, most of the seed grown in South Africa is imported from Australia, though the grass is a native of this country and was only imported into Australia a relatively short time ago.

Dactyloctenium egyptiacum, "Crowfoot grass," is an annual that is found in most of the tropical and sub-tropical regions of the world. It possesses a certain feeding value and in some countries is cultivated for hay. In Natal it is known as "Durban grass" and is used for lawns. It is said to have medicinal properties.

Other tribes represented in this list are **Zoysieæ,** represented by *Tragus* and *Perotis;* **Sporobolæ,** represented by *Sporobolus;* **Arundinellæ,** represented by *Trichopteryx.*

It may be noted here that there are few (if any) grasses that are not more or less palatable to stock in their very young stage, and that the new growth of all grasses is more nutritious than the older growth, and for that reason each grazing paddock should carry sufficient head of stock to keep the grass short, while at the same time allowing it to put on new growth.

Over-stocking will prevent this and will tend to eliminate entirely the better grasses. The best results are achieved by rotational grazing; in this way the pastures are controlled and a more or less even rate of growth ensured and the maximum feeding value attained.

In the following descriptions of the grasses as few technical terms as possible have been used, but for the sake of brevity some have had to be made use of, and for those quite unacquainted with botanical phraseology the meaning of these must be explained.

It is realised that the descriptions are very meagre and that many will fail to enlighten the layman as to the identity of the grasses described. This, however, is inevitable, as it is practically impossible in a few non-technical words to draw a recognisable picture of each grass. In many cases where a grass is very well known by its local name no description has been attempted.

Technical Terms.—*Awn.*—A long bristle-like appendage occurring on the glumes of certain spikelets; the awns of the *Andropogoneæ* are usually geniculate and hairy and often twisted below the bend. Those of the *Aristidas* are three-branched.

Culm.—The stem or "straw" of the grass that bears the inflorescence.

Geniculate.—Bent like a knee, as the awns of the *Andropogoneæ* and culms of certain grasses.

Glumes.—Chaffy bracts of the spikelet.

Inflorescence.—Flowering or seeding head.

Ovate.—Shaped like an egg in outline.

Panicle.—A loosely-branched inflorescence.

Pedicelled.—Having a small stalk.

Sessile.—Without a stalk.

Spathe.—A large bract enclosing part of the inflorescence in the *Andropogoneæ*; the spathes may be narrow and inrolled as in *Hyparrhenia filipendula*, or broad and boat-shaped as in Oat grass (*Monocymbium ceresiiforme*).

Spikelet.—The individual seed-bearing unit of the inflorescence. In some grasses each spikelet bears only one seed; in others it bears two or more. In some of the "love" grasses as many as thirty or more seeds may be borne in one spikelet.

COMMON GRASSES OF THE BLACK LAND (MATOPOS).

Andropogoneæ.—

Dichanthium papillosum (Stapf).—Resembles Australian Blue grass. Good grazing and hay grass; very palatable. (Plate I., fig. 17.)

Cymbopogon plurinodis (Stapf).—One of the aromatic grasses; widely spread throughout South Africa; of little value.

Heteropogon contortus (Roem and Schult).—"Spear grass"; palatable when young; the ripe "seeds" have caused damage to hides and skins. (Plate I., fig. 16; Plate II., fig. 6.)

Hyparrhenia filipendula (Stapf).—One of the thatching grasses; of little value for fodder. (See grasses of sand veld.) (Plate II., fig. 9).

Ischæmum glaucostachyum (Stapf).—"Turf grass"; a very blue grass with creeping underground stolons; apparently confined to the heavy black soils; very palatable to stock.

Sorghum versicolor (Anderss).—"Black Sudan grass"; annual; very palatable to stock and a useful hay grass.

Themeda triandra (Forsk).—"Rooi grass"; a useful hay grass and generally indicative of good soil.

Panicoideæ.—

Brachiaria isachne (Stapf).—"Fine false paspalum"; makes quite good grazing where it occurs naturally, but not to be encouraged in cultivated lands.

Digitaria milanjiana (Stapf).—"Milanji grass"; common on the roadsides in Salisbury, on red soil, and on vleis or the edges of vleis around Marandellas; has short creeping underground stolons; one of the finger grasses, and therefore valuable.

Digitaria ternata (Stapf).—"Annual Finger grass"; a weed on old cultivated and waste lands.

Eriochloa acrotricha (Hack).—Rather low growing, annual, with broad succulent leaves and inflorescence, resembling that of the "false paspalums," but with small green pointed spikelets; very palatable to stock.

Panicum coloratum (Linn).—Perennial, prostrate-erect blue grass; useful grazing grass; inflorescence an open panicle.

Rhynchelytrum roseum (Stapf).—"Natal red top" (= *Tricholæne rosea* (Nees)); annual or short-lived perennial on old lands; useful as hay grass. (Plate I., fig. 4.)

Setaria pallidifusca (Stapf).—"Annual Timothy"; annual millet grass (Union of South Africa); common weed in cultivated lands. (Plate I., fig. 2; Plate II., fig. 2.)

Setaria porphyrantha (Stapf).—"Purple Timothy"; a tufted, upright grass with broadish leaves; palatable to stock.

Aristideæ.—

Aristida adscensionis (Linn).—"Annual steek grass"; bad weed. (Plate I., figs. 18 and 18a; Plate II., fig. 18.)

Aristida scabrivalvis (Hack).—"Annual steek grass"; weed, with large, widely-spreading inflorescence; the branches often bare, except towards the tips, where the awned spikelets are collected in pairs.

Sporoboleæ.—

Sporobolus festivus, var. *fibrosus* (Stapf).—"Drop seed grass"; small, fine drop seed grass, tufted with mat of old fibres at the base; small delicate panicle; of no value.

Sporobolus pyramidalis (Beauv).—"Catstail"; tough, coarse grass of waste land; only palatable when very young.

Chlorideæ.—

Chloris virgata (Swartz).—"Sweet grass," "old lands' grass"; has fairly broad leaves compressed at the base and inflorescence composed of numbers of dense, white, hairy "spikes" all springing from the top of the flowering culm with a brush-like effect; annual grass; useful for hay.

Cynodon dactylon (Pers).—"Couch grass"; a cosmopolitan weed; valued for pasture and as a lawn grass.

Microchloa setacea (R. Br.).—"Sickle grass"; small, tufted, fine-leaved grass with very slender, curved purple spike, about five inches long; often dominant in sand veld, but also occurs on black and red land; no value.

Eragrosteæ.—

Eragrostis spp.

COMMON GRASSES OF THE SAND VELD (GRANITE).

Andropogoneæ.—

Andropogon schinzii (Hack).—Very like *Andropogon schirensis*.

Andropogon gayanus (Kunth).—"Rhodesian blue grass"; tall and tufted with broad, very blue-green leaves. The several pairs of white, silky "spikes," about 2½ to 3 inches long, are exserted on slender stalks from the uppermost sheaths of the flowering culm. A very palatable grass; provides good grazing or hay.

Andropogon schirensis (Hochst).—A wiry, narrow-leaved, tufted grass; inflorescence consists of rather long and hairy spikes, usually in pairs. (Plate II., fig. 5.)

Cymbopogon plurinodis (Stapf).—Leaves narrow dark green, often tinged with red or purple; pairs of "spikes" short (never more than 1 inch long) and congested into a narrow inflorescence. One of the aromatic grasses; of little feeding value.

Hyparrhenia ruprechtii (Fourn).—"Tambookie grass." One of the Tambookie grasses, tall and coarse. The inflorescence consists of numerous short paired "spikes" exserted from a narrow spathe—each spike bearing usually only one long awned spikelet, the other spikelets being awnless.

Hyparrhenia filipendula (Stapf).—Thatching grass. A fine-leaved, tufted grass with the characteristic inflorescence of the *Hyparrhenias*, that is having numerous short paired "spikes" on a very slender stalk subtended by a reddish brown spathe. Only one or sometimes two awned spikelets in each spike. (Plate II., fig. 9.)

Hyparrhenia hirta (Stapf).—In habit very like *Hyparrhenia filipendula*, but the paired spikes are very hairy, each bearing five and six awned spikelets. (Plate I., fig. 21.)

Monocymbium ceresiiforme (Stapf).—"Oat grass." A slender graceful perennial with short narrow leaves and scanty inflorescence consisting of short spikes enclosed in reddish brown, boat shaped bracts; of little grazing value.

Trachypogon plumosus (Nees).—A coarse wiry tufted grass attaining a height of four to five feet with long narrow leaves, the inflorescence consisting of one, occasionally two, long silkily hairy spikes with long, hairy, rather twisted awns. The spikelets are narrow and rather loosely arranged on short pedicels (stalk); of little (if any) economic value.

Arundnelleæ.—

Trichopteryx simplex (Hack).—Wiry narrow leaved grass, with more or less spreading panicles of narrow yellow spikelets, each with a long awn or bristle.

Chlorideæ.—

Craspidorhachis rhodesiana (Rend).—Resembles an upright finger grass, with a more rigid green inflorescence; feeding value not known.

Crossotropis grandiglumis (Rend).—Annual weed with stiff widely spreading inflorescence, the narrow, sharp pointed spikelets sessile (without a stalk) and rather far apart on either side of the almost horizontal branches; of no feeding value.

Eleusine indica (Gaertna).—"Wild Rapoko grass." (Plate I., fig. 12.) An annual providing useful grazing and hay when young, but a pernicious weed in arable lands.

Eustachys paspaloides (Nees).—"Red Rhodes grass." Used to be known as *Eustachys petrea*. The dominant colour of the inflorescence is a reddish brown; a useful hay and grazing grass.

Microchloa setacea (R. Br.).—"Sickle grass." (See Grasses of the Black Land.)

Eragrosteæ.—

Pogonarthria squarrosa (Pilger).—Hard wiry grass with a long rather narrow inflorescence, the usually short branches spreading out in curves (sickle shape); only palatable when quite young.

Eragrostis chapellieri (Nees).—A tufted very rigidly erect narrow-leaved grass with narrow inflorescence composed of many long very narrow upright spikelets. One of the "love" grasses. The spikelets are rather like those of *Eragrostis patens* (Plate I., fig. 6), but the "spikes" are longer and the grass is a perennial.

Eragrostis superba (Peyr).—"Heart seed love grass."

Eragrostis viscosa (Retz).—"Viscid love grass." A short stemmed annual; reddish purple in colour and very sticky to the touch; of no economic importance.

Eragrostis uniglumis (Hackel).—Purple topped "love" grass.

Eragrostis major (Host).—Annual love grass: rather large rigid inflorescence with broadish long ovate spikelets. Known in the Union as "Stink grass" on account of its strong scent.

Eragrostis patens (Oliver).—Annual love grass. (See Grasses of the Red Soil.)

Eragrostis patenti-pilosa (Hack).—(See Grasses of the Red Soil.)

Eragrostis aspera (Nees).—"Rough love grass." Annual.

Panicoideæ.—

Alloteropsis semialata (Hitch).—"Donker Saad" (South Africa). Upright perennial with broad hairy rather rigid leaves and digitate inflorescence; the usually dark purplish or brown more or less hairy spikelets arranged in "spikes" that are gathered together at the tips of the culms.

Brachiaria brizantha (Stapf).—"Broad leaved false paspalum"; a good hay grass; useful grazing when young.

Brachiaria dictyoneura (Stapf).—"Creeping false paspalum." Makes a dense short mat of foliage; not yet tested as a pasture grass, but should make a good grazing grass, especially for sheep. (Plate II., fig. 4.)

Brachiaria nigropedata (Stapf).—"Spotted false paspalum." Palatable to stock and a useful all-round grass.

Chloridion cameronii (Stapf).—"Gilston grass." A scantily leaved perennial sending out very long and strong but slender runners. Inflorescence rather like that of a finger grass, but with long bristles, which, however, usually lie parallel to the rhachis and are not noticeable unless the spike is bent back.

Rhynchelytrum nyassanum (Stapf and Hubbard).—"Nyassa Red Top." Much taller than the Natal red top, but with a rather narrower and more deeply coloured inflorescence. Very common on sand veld; a good grazing or hay grass.

Setaria pallidifusca (Stapf).—"Annual Timothy grass" (Rhodesia). "Annual millet grass" (S.A.). A common weed in old cultivated lands.

Setaria sphacelata (Stapf).—"Golden millet grass" (S.A.). "Golden Timothy grass" (Rhodesia). (= *Setaria aurea*.) Very good feeding value; a useful hay and grazing grass.

Urochloa trichopus (Stapf).—"Gwanda or Gonya grass." A rather straggling prostrate-erect, annual or sub-perennial, with broadish leaves; inflorescence of several erect or more or less spreading one-sided "spikes." Spikelets ovate, sharply pointed with a closely appressed fringe of white or purplish hairs along each margin; a valuable pasture grass easily established from seed.

Urochloa bolbodes (Stapf).—Larger than preceding; "spikes" longer and more spreading in all directions and spikelets without the marginal fringe of hairs. Not yet tested as a pasture grass, but should have a fairly high feeding value.

Stipeæ.—

Aristida meridionalis (Henr).—"Steek grass." A tufted, wiry grass, with large, graceful, showy, open in-

florescence, with purplish spikelets tipped with the three-branched awn or bristle that is characteristic of the genus; of little feeding value.

Aristida congesta (Roem & Schult).—"Steek grass." Annual; very troublesome on over-stocked veld; injurious to hides. Inflorescence a dense, bristly pale green or straw-coloured "spike." (Plate I., figs. 18 and 18a; Plate II., fig. 7.)

Zoysieæ.—

Tragus racemosus (All).—"Carrot Seed grass." Burr grass. A prostrate-erect annual weed with short, broad leaves. The single "spike" of the inflorescence is composed of crowded, small, spiny spikelets that are easily brushed off and become attached to the clothes of human beings and to wool or hair of animals. (Plate I., fig. 11.)

Perotis indica (Kuntz).—"Bottle Brush grass." An elegant, purple-flowered grass with conspicuous, reddish bristles and short, broad, blue-green, rough-margined leaves. (Plate I., figs. 10 to 20.)

GRASSES OF THE VLEI LAND.

Andropogoneæ.—

Amphilophis glabra (Stapf).—Resembles *Dicanthium* and "Australian blue grass." A fair grazing grass.

Andropogon eucomis (Nees).—"Snowflake grass." Inflorescence of short white plumose spikes. A scantily-tufted fine and rather short grass, conspicuous by reason of the long white hairs of short paired "spikes"; of little feeding value.

Hemarthria fasciculata (Kunth).—"Swamp couch." A rather straggling, very leafy grass. Inflorescence of narrow, compact green "spikes." A very useful grazing grass for moist soils. (Plate II., fig. 1.)

Hyparrhenia rufa (Stapf).—"Jaragua grass" (South America). A tufted perennial growing to a height of three to four feet. Inflorescence rather like that of *Hyparrhenia hirta*, but the short, paired "spikes" covered with tawny-yellow hairs. In South America said to be one of their best grazing grasses.

Imperata cylindrica (Beauv).—"Silver Spike." Inflorescence a densely white silky "spike," the very small spikelets concealed by the long, white hairs; of little feeding value. (Plate I., figs. 15 and 19.)

Rottbœllia exaltata (Linn).—"Kokoma" or "Guinea fowl grass." An annual, very leafy grass, three to five feet in height; leaves broad and flat. Inflorescence rather like that of swamp couch, but stouter and easily breaking up at the joints. Not considered of much value as a grazing grass, but useful for hay or silage; a troublesome weed grass in black vlei soils.

Eragrosteæ.—

Eragrostis namaquensis (Nees).—"Namaqua Love grass." A rather tall, coarse, love grass; the long, narrow inflorescence composed of very small reddish brown spikelets; of little feeding value.

Panicoideæ.—

Acroceras macrum (Stapf).—Leafy perennial, spreading by short underground stolons, leaves spreading at almost right angles to the stems; inflorescence narrow and rather scanty. Reported as being very palatable to stock and likely to prove a valuable grass for irrigated pastures or damp soils.

Alloteropsis semialata (Hitch).—"Donker saad." (See Grasses of the Sand Veld.)

Echinochloa pyramidalis (Hitch & Chase).—"Antelope grass" (Rhodesia). "Limpopo grass" (Union of South Africa). Tall, broad-leaved, reed-like grass. The purplish spikelets crowded into short, one-sided "spikes" on a common axis. Leaves broad and flat. Considered in the Union a very good grass for hay or ensilage.

Panicum dregeanum (Nees).—An upright not very conspicuous grass, somewhat resembling *Panicum coloratum*, but with purplish rather larger spikelets; value not known, but probably fair.

Panicum ianthum (Stapf).—A delicate grass with small open panicle of very small, hairy, dark purple spikelets on fine stalks; value not known, but not likely to be high.

Paspalum scrobiculatum, var. *commersonii* (Stapf).—"Native Paspalum." "Ditch Paspalum." A useful grazing grass on vei soils. (Plate I., fig. 3.)

Sacciolepis glaucescens (Stapf).—A slender grass with creeping root stalk; narrow rather rigid leaves with broadly sheathing base and single dense purple spikes about four to five inches long of very small crowded spikelets. Value as a fodder grass not tested.

COMMON GRASSES OF THE RED SOIL.

Andropogoneæ.—

Themeda triandra (Forsk).—"Rooi grass." A useful hay grass.

Amphilophis insculpta (Stapf).

Panicoideæ.—

Brachiaria nigropedata.—"Spotted false paspalum." "Krul grass" (Union of South Africa). (See Grasses of the Sand Veld.)

Brachiaria brizantha.—"Large seeded panic grass." "Broad leaved false paspalum." Tall, very green broad leaved perennial; the inflorescence rather like that of a paspalum, but the spikes are stouter and the "seeds" much larger and usually in one row. (See Grasses of the Sand Veld.)

Digitaria milanjiana (Stapf).—"Milanji finger grass." Tall, erect perennial finger grass with broad rather dark green softly and minutely hairy leaves, not making a dense tuft at the base, but with short, pale-coloured underground stolons covered with softly hairy scales. Inflorescence with up to about twelve (sometimes much fewer) slender, widely-spreading purplish "spikes" arranged in whorls or sub-whorls at the top of the culm, usually springing from dark purple glands. (See Grasses of the Black Land, Matopos.)

Urochloa trichopus.

Panicum maximum (Jacq).—"Guinea grass." "Buffels grass." Very palatable and valuable for grazing and hay.

Panicum repens.—"Creeping panic grass."

Panicum novemnerve (Stapf).—"Annual panic grass." Conspicuously hairy and leafy to near the base of the in-

florescence. Inflorescence a delicate, widely-spreading panicle, the small spikelets usually in twos at the end of the branches. (Plate II., fig. 8.)

Rhynchelytrum roseum (Stapf).—"Natal red top" (= *Tricholœna*).

Setaria pallidifusca (Stapf).—"Annual millet grass." Leaves rather light green, "spikes" rather short and long bristly, bristles pale gold or purplish. (Plate I., fig. 2; Plate II., fig. 3.) (See Grasses of the Sand Veld.)

Setaria sphacelata (Stapf) (= *S. aurea*).—"Golden Timothy" (Southern Rhodesia). "Golden millet grass" (Union of South Africa). (See Grasses of the Sand Veld.)

Stipeæ.—

Aristida barbicollis (Trin & Rupi).—"Steek grass." The leaves are very narrow and rather stiff, light greyish green and long and hairy at the junction of the sheath and blade. The inflorescence consists of dense "spikes" terminating the flowering culm; its branches are bare for some distance above the base. The "Steek grasses" may all be distinguished by the branched awn or bristle from each spikelet. (Plate I., fig. 18; Plate II., fig. 18.)

Zoysieæ.—

Tragus racemosus (All).

Eragrosteæ.—

Eragrostis patenti-pilosa (Hack).—A low growing perennial seldom over one foot high, the flowering culms usually bent from the lower joint and springing from a rosette of short narrow more or less hairy leaves. The inflorescence is short and rather scanty, the narrow lanceolate spikelets spreading on rather long, fine pedicels (stalks), from the base of which spring groups of fine white hairs from which the grass takes its name; very common grass of golf courses, etc.

Eragrostis ciliaris.—Perennial with a rather long, dense, narrow inflorescence, purple in colour and very hairy.

Eragrostis patens (Oliver).—Short annual with dense compact inflorescence of long, very narrow red purple, straw-coloured or greenish spikelets. A very distinctive grass. (Plate I., fig. 6.)

Eragrostis superba.—"Heart seed love grass." (Plate I., fig. 7.)

Chlorideæ.—

Chloris pycnothrix (Trin).—Annual weed, spreading and then erect, with short, flat blunt leaves very compressed at the base. Inflorescence in form like that of the Rhodes grass, but from each spikelet springs a long, fine bristle. When mature the slender spikes spread almost horizontally from the top of the culm. Very common along roadsides and on waste lands.

Sporoboleæ.—

Sporobolus indicus (L).—"Drop seed grass." (Plate I., fig. 9.)

Sporobolus pyramidalis (Beauv).—"Pyramid drop seed grass."

PLATE I.

TYPICAL FORMS OF SPIKELETS.

1. Spikelet of *Panicum* sp.
2. ,, ,, *Setaria* (Annual millet grass).
3. ,, ,, *Paspalum* (Ditch millet), back and side view.
4. ,, ,, *Rhynchelytrum* (Natal red top).
5. ,, ,, *Digitaria* (Finger grass).
6. ,, ,, *Eragrostis patens* (Love grass), actual size.
7. ,, ,, *Eragrostis superba* (Heart seed love grass), slightly enlarged.
8. ,, ,, *Eragrostis patenti-pilosa.*
9. ,, ,, *Sporobolus indicus* (Drop seed grass).
10. ,, ,, *Perotis indica* (Bottle brush grass).
11. ,, ,, *Tragus racemosus* (Burr grass).
12. ,, ,, *Eleusine indica* (Wild rapoko grass).
13. ,, ,, *Tricopteryx simplex.*
14. ,, ,, *Eustachys paspaloides* (Red Rhodes grass).
15. ,, ,, *Imperata cylindrica* (Silver spike grass).
16. ,, ,, *Heteropogon contortus* (Spear or assegai grass).

Plate I.

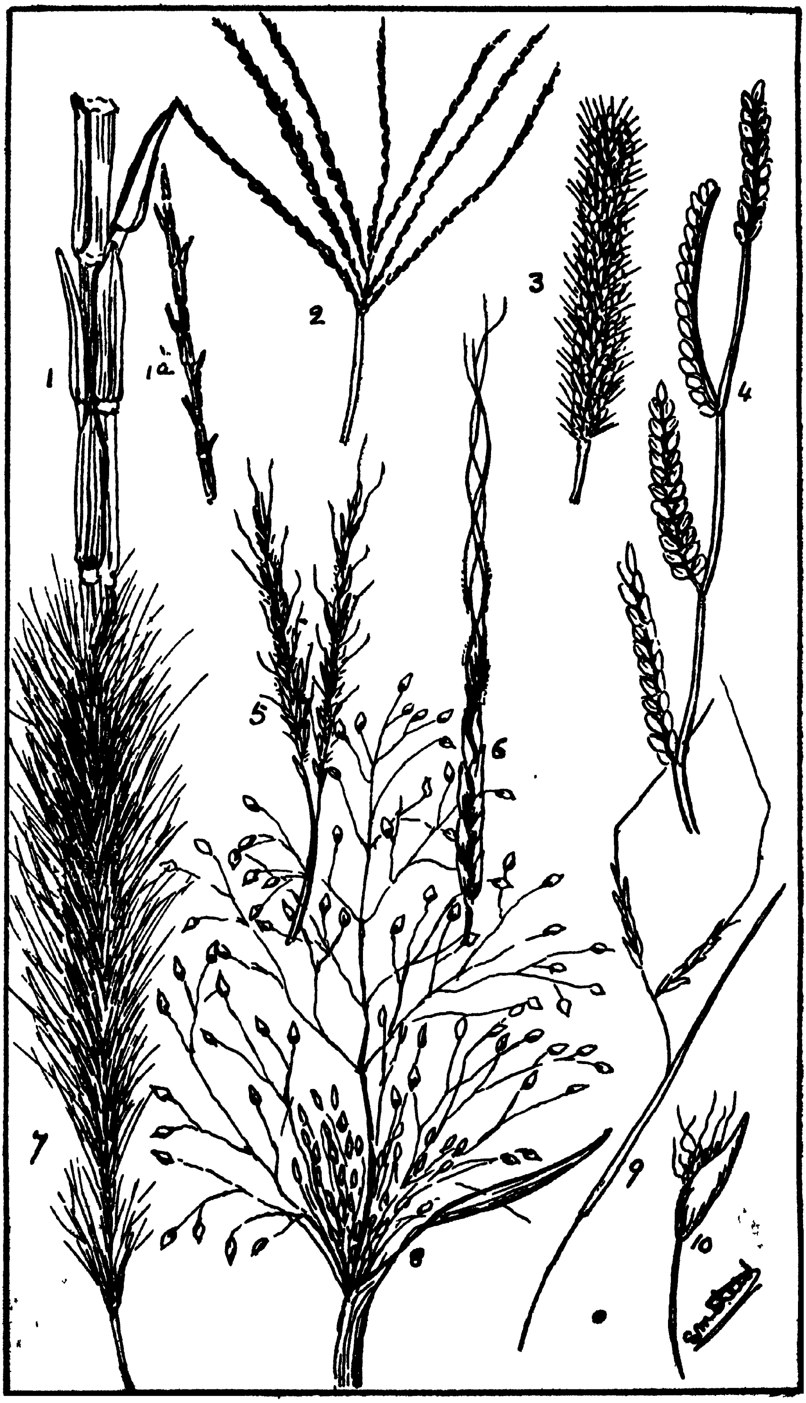


Plate II.

17. Spikelet of *Dicanthium pappilosum*, showing the paired spikelets, one sessile (without a stalk) and one stalked. This arrangement of the spikelets is common throughout the *Andropogoneæ*.

18. „ „ *Aristida congesta* (Steek grass).

18a. "Seed" of above. Note the characteristic three-branched awn and the long, hairy, sharply-pointed base.

19. "Spicate" inflorescence of *Imperata cylindrica* (Silver spike grass).

20. "Spicate" inflorescence of *Perotis indica* (Bottle brush grass).

21. Part of the inflorescence of *Hyparrhenia hirta*. Note the short paired "spikes" with several awns from each.

All the spikelets are much enlarged and the actual size shown beside each, except where otherwise stated.

PLATE II.

Typical Forms of Inflorescences.

1. Part of "spike" of *Hemarthia fasciculata* very much enlarged; the actual size shown beside it.
2. Typical form of inflorescence of the Finger grasses *Digitaria* sp., but most of them with much longer "spikes."
3. Inflorescence of *Setaria pallidifusca* (Annual Timothy grass). This is the typical form of inflorescence of the Timothy grasses.
4. Inflorescence of *Brachiaria dictyoneura* (Creeping false paspalum).
5. Inflorescence of *Andropogon schirensis*. Spikes often considerably longer.
6. "Spike" of *Heteropogon contortus* (Assegai grass).
7. "Spike" of *Aristida congesta* (Steek grass).
8. Open spreading inflorescence of *Panicum novemnerve* (Annual panic grass).
9. Part of the inflorescence of *Hyparrhenia filipendula*. Note the paired "spikes" with one or rarely two awns to each "spike."
10. Spikes of *Monocymbium* enclosed in broad spathe.

The Raising of Forest Seedlings and Transplants on the Farm.

By E. J. Kelly Edwards, M.A., Dip. For. (Oxon.),
Acting Chief Forest Officer.

The following article on nursery practice is intended to meet the requirements of the farmer and general tree planter who find it more suitable, for reasons of economy in transport and expense, to raise their own transplants than to purchase stock raised by nurserymen. The procedure advocated refers mainly to the commoner trees planted in this Colony, viz., eucalypts, pines, cypresses, callitris, cedrela and jacaranda.

Source of Seed.—Seed may be purchased from Government Forest Nurseries as quoted in Departmental price lists, or from nurserymen of standing. If, however, trees of the species it is desired to establish are thriving in the locality, it may be cheaper to collect seed from them. Only well formed mother trees should be selected, and, *ceteris paribus*, trees bearing excessively heavy crops of seed should be avoided, as their condition may indicate ill-health or non-suitability to the locality.

Branchlets carrying ripe seed vessels or cones should be picked and piled on a sheet of canvas or some large open vessel, and placed in the sun in a spot protected from wind. In the course of two days to a fortnight the vessels will open and free the seed. Shaking and turning over the pile will accelerate liberation. The seed is finally collected from the threshing floor, and, if not to be sown immediately, should be stored in a cool, dry place. It is obvious that single seeded fruits will not need this treatment.

Quantity of Seed for Planting Requirements.—It is wise to sow sufficient seed to produce more plants than the ulti-

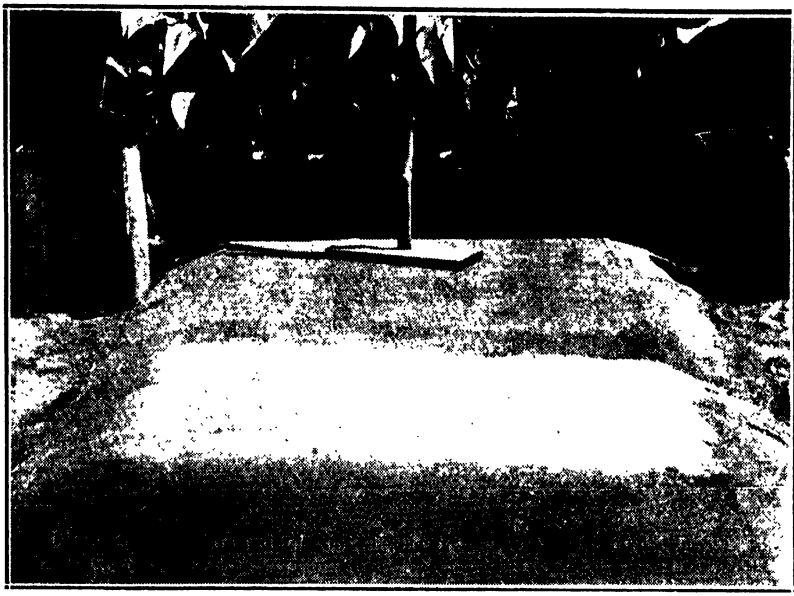


Plate No. 1.—Method of making seed beds. Note board for levelling the beds. Seed sown on bed in foreground; seeds covered with fine sand beyond; part of bed beyond not sown.

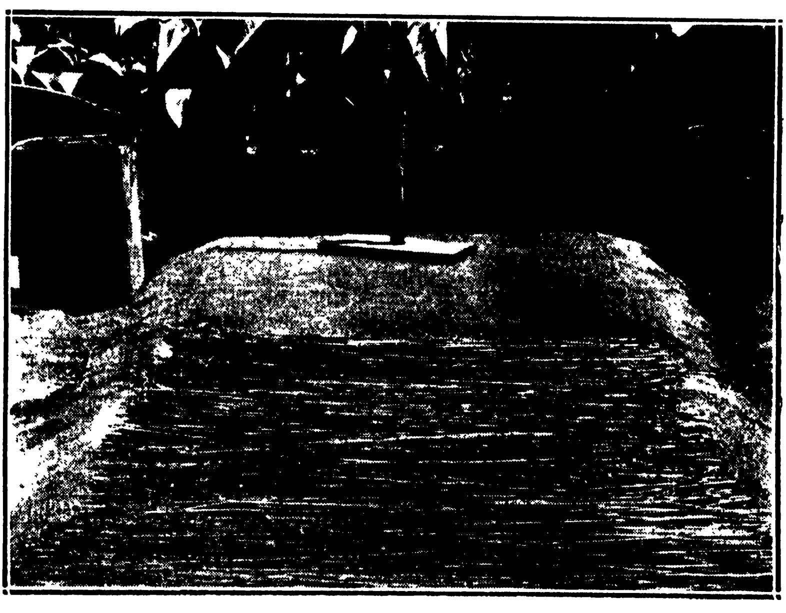


Plate No. 2.—Method of covering beds with grass. Well combed grass should be used.

mate number per acre required for planting. To ascertain the approximate number of plants required per acre for any planting distance, in the more usual square-planting, the rule is to divide the number 43,560 by the square of the planting distance, thus:—

$$\text{Planting distance} = 6 \text{ feet by } 6 \text{ feet}$$

$$\text{Number of plants required} = \frac{43{,}560}{6 \times 6} = \frac{43{,}560}{36}$$

$$= 1{,}210 \text{ plants}$$

In order to produce at least 1,210 plants, the following quantity of seed should be sown:—

Eucalyptus saligna, *E. botryoides*, *E. rostrata*, *E. tereticornis*, *E. punctata*, *E. maideni*, *E. microcorys*.	1 oz.
Pinus insignis, *Cupressus torulosa*, *Cupressus lusitanica*, *Cupressus arizonica*, *Callitris calcarata*, *C. robusta*, *Cedrela toona*	3 ozs.
Pinus longifolia	4-5 ozs.

Time of Sowing.—Eucalypt seed may be sown during September to mid-December for planting out during the same rainy season.

Cedrela toona should be sown fresh immediately after ripening in November-December for planting out during the same rainy season.

Seed of pines, cypresses and callitris may be sown during February, March and April for planting out in the following rainy season.

Seed of *Aleurites fordii* may be sown from July to September.

Preparation of Seed Beds.—The nursery should be in a locality near permanent water, protected from winds and carrying a well drained soil. Due regard should be paid to the distance of the planting area and, to facilitate supervision, the homestead.

The soil should be well broken up and reduced to a fine tilth. No sticks, stones or clods should be left in the upper 3 ins. of soil. Sterilising by burning and fertilising is not ordinarily necessary. A light sandy loam is suitable for a

temporary nursery. For a permanent nursery a mixture of heavier soil and leaf mould may be added to the end that the soil will be both friable and retentive of moisture.

When the soil has been well tilled, beds 3 ft. 6 ins. in width, of any suitable length, and about 20 ins. apart, should be marked off, levelled and pressed down to ensure a smooth surface. Plate 1 shows a suitable implement to smooth the surface of the beds. It consists of a board nailed to a handle.

As an alternative to the use of seed beds, half petrol tins, filled with soil as already indicated, may be utilised. They have the advantage of being easily transportable to the pricking-out site, and, when uneven germination is experienced, they enable the grower to work systematically with the seedlings as they reach the pricking-out stage. Direct planting is not ordinarily advisable from seed tins.

Sowing the Seed.—Seed may be sown broadcast, the density of sowing being dependent on the desired subsequent treatment. If it is intended to prick out seedlings into tins or trays, 3 to 4 ozs. of eucalypt seed and 6 to 8 ozs. of conifer seed may be sown to the square yard. The easiest way to gauge the density of sowing is to aim at a condition where slightly more seed is visible on the seed bed than soil.

If the seedlings are to be planted out direct from the seed beds a much lighter sowing—about 1 oz. to every 10 to 20 sq. yds.—should be carried out, dependent on the size of the seed.

For planting out direct, line sowing may also be adopted. Seed is sprinkled along the surface of the bed, or dibbled-in, in the case of large seeds, in lines about 6 ins. apart. This system naturally requires more space than broadcast sowing, but it has the advantage that thinning, weeding and root pruning operations are facilitated.

Broadcast sowing by hand gives good results in most instances. With very fine seed it may be sometimes advisable to mix the seed with fine sand to ensure even distribution. The sowing of eucalypt seed through a watering can is neither necessary nor advisable. When the seed has been sown it should be covered with a layer—the depth equal to

the breadth of the seed—of sand or other soil which has previously been put through a sieve of fine mesh. The beds, or seed tins, should now be covered with well combed grass of sufficient thickness so that the soil cannot be seen. See Plate 2. As the grass may come in direct contact with the seed it is important to have it well cleaned, otherwise "white ants" may be attracted to the beds. A good watering should now be given to the seeds through the grass. Hessian may be used instead of grass, but, especially with eucalypts, it renders the operation of gradually lessening the shade more difficult.

Care of Seed Beds.—Watering of the beds should be carried out once or twice daily. The weather conditions prevalent over the germination period will indicate the frequency of watering desirable. Success lies in keeping the soil moist, though not sodden. Germination should take place within four to eight days in the case of eucalypts and cedrela and ten to fourteen days or more for pines, cypresses and other conifers.

When germination is complete most of the grass should be removed, a very light covering being left for a few days to enable the young seedlings to harden off. All the grass should then be removed. If the grass is left on too long the seedlings will tend to spindle and will be useless for pricking out. This operation of removing the shade gradually is very important, especially with eucalypts, which are extremely tender in early youth.

In the case of beds sown for plants to be planted out direct in the field, the seedlings should be thinned out where they are too dense, leaving about 80 seedlings to the square foot. Thinning should be done by cutting out undesirable plants. Pulling is bad practice, as it damages the roots of the plants which are to remain. Weeding should be carried out whenever necessary, and waterings must also be frequent.

With eucalypts, when the young plants have from six to ten leaves, root pruning should be resorted to at intervals of about three weeks to encourage the formation of a fibrous root system. The operation is carried out by inserting a long-bladed knife or sharp spade 4 to 5 ins. below the surface. With other species root pruning should start when

the plants are $1\frac{1}{2}$ to 2 ins. high. Line sowings are more easily treated by this operation. See Plate 3.

Inoculating Soils for Pine Seedlings.—It is necessary at this stage to draw attention to a soil requirement which appears to be essential to healthy pine growth in various parts of the Colony. This requirement is a fungus which, apparently acting in association with the roots of pines, enables them to carry out their normal function. Without

Plate No. 3.—Method of raising trees in lines in the beds (cutting the tap roots).

this fungus assistance the young pines tend to remain stunted and to bear an unthrifty, sickly yellow appearance. It would appear that the soils carrying thriving pine plantations are well infected with the fungus. When soil from such plantations is introduced to new nurseries, healthy pine seedlings result. This procedure is now advocated wherever pines are to be raised. It is well to inoculate the soil both in the seed and transplant beds or tins. A handful to the square foot would suffice, and should be forked or raked into the new soil.

Pricking Out.—The primary object of all pricking out is to ensure that each plant shall have a well-developed root system. Where seedlings are pricked out into tins or trays, the resulting transplants are finally planted out with a ball of earth surrounding each root system. In inexperienced hands and in a climate where droughts are frequent, balled plants are liable to less risks in planting out and are more capable of readily establishing themselves than open-rooted plants, which are used when seedlings have been pricked out into beds. The latter method is obviously cheaper, although it is in turn more expensive than the use of plants set out direct from seed beds.

Pricking Out into Tins or Trays.—Petrol tins cut longitudinally in half or wooden boxes approximating them in size are most commonly used for the reception of pricked out plants. A few holes to facilitate drainage are punched in the bottoms of the tins, which are then filled almost to the top with, preferably, previously prepared soil. Such prepared soil might consist of three parts heavy loam, three parts sand and one part well rotted vegetable matter. This should be will mixed, sieved if necessary, watered and thrown into a heap until required. The object is to obtain a soil which will bind slightly and not give off moisture too rapidly.

The soil in the tins is then watered, and holes, equidistant and 25 to 30 per tin, are made either with a pointed stick alone or with the assistance of a dibbling board, of a size to fit the tin, with holes about half an inch in diameter spaced as required. A dibbling stick is inserted through these holes into the soil. The tins are now ready for the pricked out seedlings.

The operation of pricking out is best carried out in the shade. It is well previously to construct a simple shade house made of poles, with a loose roof of branches carrying sufficient foliage to allow plenty of light within the structure, at the same time appreciably lessening the intensity of the sun's rays. A portion of the shed should be fitted up with a rough table and have complete shade overhead. The tins containing the soil are placed on the table ready for the seedlings. Seedlings are ready for pricking out when they

are about 1½ ins. high, and in the case of eucalypts, when they have two to three pairs of leaves. With a spade a clod of earth carrying sufficient seedlings to fill two or three tins is dug out and carried quickly to the table in the pricking out shed. Great care should be taken to expose the roots as little as possible to the air. With a pointed dibbling stick the seedlings are removed from the clod of earth one by one and quickly examined. If the tap root is too long and obviously out of proportion to the rest of the plant, it should be nipped off with the thumb and forefinger, leaving a root which is half as long again as the stem. If the tap root is badly bent, or the seedling otherwise ill-shaped or unhealthy, the plant should be thrown away. The plant, having been examined and found suitable, is inserted into the prepared hole, and the soil is pressed against it from the side with the dibbling stick in such a manner that the root is not bent and that there is no air pocket at the base of the hole. The seedling should be inserted no deeper than it stood in the nursery bed, *i.e.*, at the collar. A seedling pricked out with a bent tap root, or with the collar deep in the soil, starts with a handicap from which it will never recover. It simply means waste of money, labour, time and a gap in the plantation.

As each tin is filled with plants it is placed in the partial shade of the other part of the shed and watered through a fine rose. Subsequent waterings need only be given when the soil shows signs of drying out. After a week or ten days in the partial shade the tins are placed out in the open sunlight, where the plants are allowed to harden off.

Pricking Out into Beds.—If it is desired to use open-rooted plants, pricking out into transplant beds will ensure better individual root systems than are obtainable with seedlings set out direct from seed beds. The same treatment and method of preparing the beds are followed as already described. Holes are prepared in the beds with a dibbling stick through a dibbling board in which holes have been bored with an espacement of, say, 2 ins. by 3 ins. Tins or clods of earth containing seedlings are carried to the beds, where pricking out is done as before. Temporary and partial shade may be erected over the beds, and may be maintained during the hardening-off process.

Care of Plants Prior to Planting Out.—Plants which have been pricked out into tins or beds, or which have been left in the nursery beds for direct planting, should be watered frequently; dead plants should be replaced and weeding carried out. If planting rains are long delayed and the young plants show a tendency to too rapid growth, this growth should be checked by watering very sparingly. The plants should in effect be made to struggle. The leaves, if the plants are given sufficiently short rations of water, will take on a bluish or brownish colour. This need cause no alarm, as hardy plants will result. On the other hand, this will be the sign that a watering must be given soon in order to keep the young plants alive. If the planting of trees contained in tins is held over for any length of time, periodical inspections should be made by turning over the tins and pruning off all the roots which have come through the drainage holes.

Conclusion.—A perusal of the foregoing pages will show that even the least experienced may achieve success in raising trees, *provided adequate care and supervision of the necessary operations are exercised.* Neglect and haphazard methods must inevitably lead to failure and disappointment. In rearing human and other animal juvenile life the most elaborate precautions are taken. Trees, also, are living things, and, though their protests against harsh treatment may be voiceless, they are none the less entitled to consideration.

DATES OF AGRICULTURAL SHOWS.

Midlands Agricultural Society, Gwelo, 12th June.

Umtali Agricultural Society, Umtali, 24th and 25th July.

Bindura Agricultural Society, Bindura, 25th July.

Rhodesia Agricultural Society, Salisbury, 26th and 27th August.

Bulawayo Agricultural Society, Bulawayo, 2nd and 3rd September.

The Grading and Handling of Fire-cured Tobacco.

By H. F. ELLIS, M.Sc., B.Sc. (Agric.), Tobacco Adviser.

It is hoped that the following notes may prove of some value to the large number of new growers of fire-cured tobacco, the majority of whom have had very little experience in handling this particular crop.

The tobacco should not be removed from the barn until it can be handled without breakage. This condition can usually be obtained by the use of wet sacks on the flues, by steaming under low pressure or by leaving the doors and ventilators open overnight. When this stage is attained, the tobacco should be hung closely in the pit for a day until it has absorbed sufficient moisture to make the leaf thoroughly pliable and workable.

On removal from the pit the tobacco sticks should first go to a table, where the leaves are stripped from the stems and the tobacco is sorted into sizes. The usual sorting lengths are as follow:—

(1) Under 17 inches.

(2) 17 to 22 inches.

(3) 22 inches and over.

From the sizing table the leaf should go to the grading table, and, to get the best results, it is essential that only one size should be graded at a time. The tobacco should be sorted into grades, based chiefly on the body and gum of the cured tobacco. Any tobacco showing the slightest tinge of green should be thrown out and bulked down in fairly high condition to remove the green. Any leaf of a dark brown colour, due to excessive smoking, should be graded separately, even though the percentage of these

leaves is likely to be small. Given a normal crop, the total number of grades should not exceed six or seven.

When graded, the tobacco should be tied in hands of eight to twelve leaves, depending on the size, and the tie leaf should be of the same grade as those in the hand. The tobacco should be in fairly high condition to prevent breakage, and should be baled to give approximately 150 lbs. per bale. If the leaf is baled in fairly high condition, it should be sent in to the buyers as early as possible in order to prevent any of the contents of the bale from becoming mouldy.

Farm Butter Making.

Issued by the DAIRY BRANCH.

[*The following article, which appeared in the* Rhodesia Agricultural Journal *of August*, 1926, *is reprinted in response to the constant demand for information on the subject.*—Ed.]

Although creamery butter is principally consumed in this Colony, a large amount of farm butter for local consumption continues to be made. A good deal of this butter, especially in the summer season, is of a low grade quality, and therefore it would seem likely that an article on farm butter making may be of value to farmers and new settlers.

Utensils Required.—(a) *The Churn.*—The end-over-end type of churn is recommended. This should be made of well seasoned oak, fitted with means of ventilation and with a small window through which the state of the cream can be observed without removing the lid. The lid should be of sufficient size to enable the contents to be removed without any difficulty. The churn must, of course, be kept scrupulously clean and sweet, and when not in use should be filled with clean cold water. Metal churns, when butter is only occasionally made, are serviceable, but their design precludes them from having the advantage of the old-fashioned wooden end-over-end type.

(b) *Butter Worker.*—This should be fitted with a roller, by means of which water can be expelled from the butter. It is almost impossible to work any quantity of butter by any other means. Insufficient working causes the retention of large quantities of water or buttermilk, thereby causing the butter to be of an inferior quality.

(c) *Scotch Hands, Butter Scoops, etc.*—These are made of wood, and, like the churn, are scalded and kept sweet and clean when not in use.

Preparation of a New Churn.—Fill the churn with lukewarm water and allow to soak for at least twelve hours. Should the churn leak, the water must be replaced. Wash with hot water in which ordinary washing soda has been dissolved. This will remove all the natural brown stain from the wood. Wash again with lukewarm water and again with cold. Scald with boiling water, and give the churn a few turns, taking care to press the ventilator after each turn. If the preparation is complete, the water should come off quite clear. The churn should then be well scrubbed with salt and filled with clean cold water. A new butter worker should be treated in a similar manner.

Preparation of Cream for Butter Making.—The *Rhodesia Agricultural Journal* for June, 1920, gives full instructions for the preparation of cream either for churning or for despatch to a creamery. Owing, however, to the amount of inferior cream produced on farms throughout the Colony, a recapitulation of the points detailed in the Journal will perhaps be of service.

To obtain a First-Grade Cream.—

1. Observe every precaution to ensure the production of clean milk.
2. See that the separator is properly mounted and properly manipulated.
3. After using the separator, take out the working parts, wash them in warm water, using a brush, and then scald them in boiling water. Never assemble the parts until immediately before use.
4. Always use two receptacles when handling cream for farm butter making, the first for receiving the cream from the separator and the second for storing and ripening cream.
5. Always cool the cream immediately separation is complete by immersing the vessel containing it in cold water.
6. Never mix warm cream with cold cream.
7. Keep the cream in an open can or jar, covered with clean muslin. In warm weather stand the can in water and put wet cloths round. Allow to stand in a draught.

8. If butter is made only once a week, keep the cream as cool as possible by allowing the cream can to stand in cold water.
9. Stir the cream at least three times a day.
10. Keep the cream in a clean airy dairy where the atmosphere is pure and untainted.
11. When sufficiently ripe for butter making, cream should have a clean, sharp acid flavour and a smooth velvety appearance. The acidimeter test should show about .5 per cent. development of lactic acid.

Preparation of Utensils for Butter Making.—*The Churn.*—Scald with boiling water, giving only half a turn before allowing the steam to escape through the ventilator. Then give another turn, and, removing the lid, run off the hot water as quickly as possible and replace with cold water. Give one or two turns, and allow the churn to hang with its lid hanging downwards. During the greater part of the year in Rhodesia it is necessary to prepare the churn the evening previous to butter making, filling it with the coolest water obtainable (from water bags for preference), and, removing the churn outside the dairy, expose it, with lid removed, to the night air.

The Butter Worker.—Scald the butter worker with boiling water, paying particular attention to the scalding of the roller. Run the boiling water off, and whilst it is still running, pour on cold water. Run the cold water off, and scrub with salt, leaving some damp salt on the roller. Replace plug and fill the worker with the coldest water obtainable, giving the roller a turn round in the cold water and covering it with a wet muslin cloth which hangs over into the water. Expose to the night air in warm weather.

Preparation of Cream for Butter Making.—The thickness or consistency of the cream, its appearance, its degree of ripeness and its temperature are most important. When cream is ready to churn, it should not be too thick. If it is in this condition, add cold water until it runs off a wooden stirrer without clinging to it. If the cream is too thick it will stick to the sides of the churn and cause difficult churning and a loss of fat in the buttermilk.

The Churning Temperature.—This is of extreme importance. *It is always necessary to use a thermometer* in butter making, as control of temperature is one of the most important points to be considered in successful dairying. The following temperatures may be found a help:—

Temperature of Dairy.	Churning Temperature.
66 degrees F.	55 degrees F.
64 degrees F.	56 degrees F.
62 degrees F.	57 degrees F.
60 degrees F.	58 degrees F.
58 degrees F.	59 degrees F.
55 degrees F.	60 degrees F.
50 degrees F.	62 degrees F.

When the temperature is either too low or too high, undesirable results are obtained. A low temperature prolongs the churning period unnecessarily, and may even make it impossible to churn the butter. It causes the granules, especially when the cream is thin, to form tiny pellets like fine shot. The working of the butter and the incorporation of the salt are accomplished only with great difficulty, and the "body" of the butter is spoiled.

Adding hot water to the cream in winter is a bad practice, as it causes a weak-bodied greasy butter and a loss of butter fat. The only satisfactory method of warming the cream to the proper churning temperature is to put the bucket or jar containing the cream into a tub or tank of water at a temperature of about 95 degrees, and replace the water when cold. The cream during the warming-up process must be stirred frequently, in order that it may be warmed uniformly throughout. It is, however, more necessary in this country to cool the cream than to heat it up, and the absence of any cooling plant or refrigerator on farms makes it a most difficult matter. However, some means should be devised to lower the temperature as much as possible. One of the most common as well as perhaps the most effectual is to hang the cream can, jacketed with a wet flannel or sacking cover, somewhere in a shady place where it is exposed to any breeze that may be blowing. The jacket round the can should be kept thoroughly wet, and this treatment will result, in favourable weather, in a lowering of the temperature to as much as 10 degrees below air

temperature. In order to reduce the temperature as much as possible, it is always advisable to divide the cream into several lots, say of about 1½ gallons each, and cool it as already described. A quicker lowering of temperature will result than if the cream is cooled in bulk. At the same time, cold water from water bags should be used to thin the cream. If the churning is done just before daybreak, a satisfactory grain should be obtained, as it is perfectly feasible, by this means, to reduce the churning temperature to about 60 degrees F. Most butter made in the summer months is of poor quality, because very little attempt is made to control the churning temperature, with the following results:—

1. *Loss of Butter Fat in the Buttermilk.*—When the churning temperature is high enough to reduce the churning period to 10 or 15 minutes, the loss of butter fat may be as much as 2 per cent.; whereas, under proper conditions, the loss does not exceed 0.2 per cent.

2. *The Quality of the Butter is Injured.*—

(a) Too much buttermilk is left in the butter. When the butter granules are so soft that they stick together in large masses, the washing out of the buttermilk is impossible, and large quantities are incorporated with the butter. Such butter has poor keeping qualities, and bad flavours are developed. These bad flavours are caused not by the decomposition of the butter fat, but by the decomposition of either the casein or white matter locked up in the butter.

(b) Too much moisture is left in the butter. This appears as large drops when the butter is cut and pressed between the Scotch hands. Many farm butters made in the summer contain as much as 25 per cent. of moisture, whereas the legal standard for moisture content in farm butter in most countries is a maximum of 18 per cent., and in creamery butter 16 per cent.

(c) A weak, greasy body is caused in the butter. Butter properly made at the correct temperature has a firm, waxy body, and is close in texture.

(d) White streaks appear in the butter, due to the inability of the butter maker to wash out the excess buttermilk.

If the proper temperature is observed, the churning period occupies from 25 to 35 minutes. Patent churns which churn butter in seven to ten minutes often produce the harmful results already described.

The cream, when of the right consistency and temperature, should be poured into the churn through a straining cloth. This will have the effect of breaking up any lumps and also of removing any curd particles which, if not removed, will cause white spots to appear, and also cause the butter to develop bad flavours. The bucket is cleaned by means of the squeegee, and any cream remaining in the straining cloth squeezed through into the churn. The churn should never be filled to more than about one-third of its capacity.

Churning.—Begin churning slowly, and ventilate every twenty revolutions until no air or gas escapes when the ventilator is pressed. Then increase the rate of turning to that fixed for the type of churn used, and turn regularly until the cream "breaks" and the granules of butter appear on the glass. The sound made by the cream in concussion indicates also that the butter is being formed. The churn should then be revolved slowly several times and stopped, and the butter examined to guard against over-churning. If the grains are sufficiently large, add a quart or more of breaking water at a temperature (if possible) 2 degrees lower than the churning temperature. Give two or three slow turns to make the grains rounder; when finished, they should have the appearance of mustard seed, and should be the size of rather large shot. When the grain is of the right size, draw off the buttermilk, using a hair sieve (covered with butter muslin) to catch any grains which may be washed out with the buttermilk.

Washing the Butter.—The object of washing is to remove the buttermilk, and whilst the last of the buttermilk is draining from the churn, the washing water should be prepared. Clean cold water only should be used. It should be about 4 degrees lower than the churning temperature. In summer the coldest water obtainable should be used for

this purpose, and if salt is used to form a weak brine, so much the better, as the addition of salt will bring down the temperature from 1 to 2 degrees. After the plug is put back, the washing water should be poured into the churn and the lid replaced. Four to six sharp turns are then given. The washing water is drawn off and the washing repeated. Two washings are enough, as excessive washing has the effect of bleaching the colour and causing loss of flavour.

Salting Butter.—Brine salting is recommended for fresh farm butter. A brine made in proportion of one pound of salt to one gallon of water will give a sufficient degree of salting for most markets if the butter is left in the brine from 15 to 20 minutes. A stronger brine left in the butter for a longer period will give a more highly salted butter. The brine should always be strained into the churn, to prevent specks of dirt or granules of undissolved salt getting into the butter.

The Advantages of Brining.—

(1) The addition of salt to the water brings down its temperature about 2 degrees, and this in the summer firms up the grain to a very considerable extent.

(2) It improves the flavour and, being evenly distributed, obviates the formation of white streaks through the butter.

(3) The butter requires less working, and can be made up at once.

Dry Salting.—Dry salting is not recommended, although it economises salt. Dry salting very often results in white streaks being formed, and the butter is often full of particles of undissolved salt. The amount of salt varies according to taste. One-half to three-quarters of an ounce of salt to one pound of butter will give a fairly heavy salting, but these proportions can be exceeded if so desired. Good salt must always be used, and it should be free from dirt, and should remain dry for a considerable time if kept in a suitable place. When used for dry salting, it should be ground to a fine state of division, and sprinkled on the butter through a hair sieve in two or three portions in the manner described under the head of "Preserving Butter."

Removing Butter from Churn.—The butter, after remaining for about 15 to 20 minutes in the brine, should be removed from the churn by means of a butter scoop on to a sieve covered with butter muslin. The sieve is held over a bucket which catches the drippings, and when the sieve is full the butter is transferred to the butter worker. If all the butter cannot be removed from the churn at one operation, the butter already in the worker should be covered with a wet muslin cloth until the next portion is placed with it. The few grains of butter which cannot be gathered, or which cling to the sides of the churn, can be washed through the plug hole with the brine and caught in the sieve. Care should always be taken in taking the butter out of the churn not to scrape it against the sides of the churn, as this butter is not easy to remove and may cause the sides of the churn to become greasy and sticky.

Working the Butter.—When using the roller to consolidate the butter and expel the moisture, great care should be taken not to rub it on the butter worker. The roller is so constructed that, properly manipulated, it will give the requisite pressure to work the butter without any rubbing or friction. No more butter should be placed on the worker than can be conveniently worked.

Do not Overwork.—Too much working is a common fault of farm butter. Such butter has a dull, greasy appearance, and its texture is spoiled. Well-worked butter should be just so dry that, when cut and squeezed between the Scotch hands, only a very small number of drops of water appear on the cut surface; and at the same time it should break with a granular fracture, showing the grain quite distinctly, like broken steel. Properly made butter should not contain more than 16 per cent. of moisture.

Do not attempt to work Butter when too soft.—By doing so you will cause the butter to become greasy, and it will be impossible to work the moisture out of it properly. When in too soft a condition to work, the butter should be spread out on a plate, covered with a damp muslin dipped in brine. It should be placed in as cool a place as possible, and exposed to a cross draught between window and door. It is a good practice to stand the plate or receptacle containing the butter in a shallow bath containing water, so that the

butter muslin dips into the water and remains constantly wet. After such treatment the butter is usually in a condition firm enough to work. This working should, in the summer, be done either at daybreak or before if possible.

For market, the rectangular one-pound package is the most suitable. It should be wrapped in good quality wrapping paper 11½ inches long by 8½ inches wide, on which some distinguishing brand is printed. Small wrapping papers are unsatisfactory. As soon as wrapped, the butter should be placed in an ice chest, if ice is available, or in a cool place and covered with wet butter muslin.

Washing up Dairy Utensils.—The churn should be almost free from butter after the brine has been run off. It should be washed with warm water, and all traces of butter removed. Give the churn a few turns, ventilating frequently, and let out the warm water. Next scald with boiling water, being very careful to ventilate at every turn of the churn. Run off the boiling water and fix the churn at an angle to allow of free drainage. The rubber band should be removed and all the metal work dried and polished. Leave the lid off and turn the churn upside down to dry. The butter worker, Scotch hands, sieve, etc., should be well scrubbed with a brush, using warm water after a preliminary washing. The butter muslin should be washed and scalded and hung up to dry. All the utensils should be neatly arranged on the butter worker and the dairy washed down with boiling water and left to dry.

Preserving Butter.—It is extremely difficult in a semi-tropical country to preserve butter made in the summer for winter use unless ice or artificial refrigeration is available. Butter intended for storing should preferably be dry salted, as an excess of salt has always a preservative influence. The butter must be churned and washed most carefully, as the success of these operations has the utmost effect on the keeping qualities of the butter.

The butter is placed on the butter worker and worked just enough to make it into a solid lump. It should then be weighed, and salt in the proportion of half an ounce to three-quarters of an ounce to one pound of butter weighed out. The salt should be divided into two or three portions. The butter should be rolled out, and the first portion of salt

evenly sprinkled over the butter through a dry hair sieve. The butter is then rolled up and put away for an hour or two until the salt is dissolved. The operation of salting with each of the other portions of salt is done in exactly the same way. When the last portion is added, the butter should be worked fairly dry; it is then ready for "potting" or preserving. Press the butter into a glazed jar, being careful to consolidate it well by pressure so as not to leave any air spaces. When the jar is full, a piece of grease-proof paper is placed over the butter and covered with a good thick layer of good dairy salt. The jar is then tied down with parchment paper and stored in the coolest place obtainable.

Another successful method of putting down butter is by "pounding" it, wrapping it in muslin instead of butter paper and storing it in strong brine. A piece of thread fastened longways round the pounds of butter will prevent the wrapping from working loose. A round lid, somewhat smaller than the cask in which the butter is stored, is floated on the brine, and enough weight placed upon it to keep the butter well under.

SUMMARY.

(1) To prepare churn, butter worker and other wooden utensils:—

(a) rinse with warm water;

(b) scald with boiling water;

(c) rub thoroughly with salt;

(d) rinse with cold water.

(2) In warm weather prepare the utensils overnight and churn before daybreak.

(3) *Always use a correct dairy thermometer.*

(4) Use every means at your disposal to get the correct temperature for churning.

(5) Strain the cream into the churn through a straining cloth.

(6) Never fill the churn more than half full.

(7) Ventilate frequently.

(8) Turn the churn at the speed indicated on the handle.

(9) Stop churning when the butter comes, and, taking off the lid, examine the contents of the churn.

(10) *Do not over-churn.*

(11) Wash the butter twice only.

(12) Use brine for salting. This firms up the butter in the churn.

(13) Do not put too much butter on the butter worker.

(14) *Do not over-work.*

(15) Make up the butter neatly into brick-shaped pounds.

(16) Use good paper.

(17) Keep your butter in a cool place covered with damp cloths.

(18) Use a special box for sending your butter to market.

European Maize Market.

It is a matter for concern that the Balkans cannot sell maize at present prices, and so take advantage of the broadening demand in Northern Europe. An international price of 14s. per quarter c.i.f. gives the Eastern European grower no chance of a profit. His position is almost hopeless, as would be that of the French or German grower asked to accept 20s. per quarter for his wheat. Hopes, however, are entertained that as a result of representations made through the League of Nations and other political channels some measure of preference will be accorded Eastern European grain by the importing countries of the west. It is too early yet to regard this development as a definitely bearish point for our international market, but certainly something will have to be done to save the Balkans from economic disaster. —(George Broomhall's *Corn Trade News.*)

Measles in Swine.

By P. D. Huston, M.R.C.V.S.

This is probably the commonest and most widespread disease of swine in Southern Rhodesia. The condition, which in appearance looks like a number of small pearl-shaped bladders no longer than a small pea, embedded in the muscle fibres and occasionally surrounded by a watery fluid, is due to the presence in the muscles of the *Cysticercus cellulose*, which is the bladder worm stage of the *Tænia solium*, the commonest tapeworm of man. The term bladder worm arises from the shape of the cyst and the fact that it contains fluid.

The muscles most commonly invaded are those of the tongue, neck, fillet, shoulder and thighs. During life it is said that infected animals can be detected by the presence of the cysts in the muscles of the tongue. To do this the tongue has to be drawn forward out of the mouth and the under surface of it examined, when the cysts will look like small pearls under the surface. It will be found that this method is only very seldom successful, because although the tongue is commonly, it is not always infected, and even if it is infected, it may not be possible to see the cysts. *Post-mortem* examination is the only means by which it can be determined that an animal is not suffering from measles. The cysts, if not liberated during their life, may degenerate, and on *post-mortem* examination will appear as greyish coloured bodies embedded in the muscle, which, if cut into, are either caseous or calcareous according to the age of the lesion.

There is no curative treatment for the disease, but an account of the life history of the tapeworm will give a direct indication of the preventive treatment necessary to reduce the infection to a minimum.

The eggs are found in the excreta of man, and when the excreta are eaten by the pig the gastric juices dissolve the outer coat of the ovum and liberate the embryo. The embryo on passing through the bowel wall is taken up by the blood stream and carried to its destination, where it becomes encysted; development then commences, and it takes about three months for a cyst to reach maturity. The muscle so infected has now to be eaten by man in a raw or partially cooked condition, so that the vitality of the mature cyst is not affected; the cyst on reaching the stomach is dissolved by the digestive juices, and the scolex or head of the tapeworm is liberated. In the *Cysticereus cellulose* there is only one scolex in each cyst, so only one tapeworm can develop. The scolex becomes attached by hooks to the stomach wall, and growth commences by the formation of segments behind it, the oldest segments being furthest away. In four to five months the segments become mature and are cast off, to be passed out in the fæces of man to infect further animals. Each worm can produce eight to nine hundred segments, and each mature segment may contain up to ten thousand eggs.

From this life history it will be seen that only three conditions are necessary to reduce the extent of the infection.

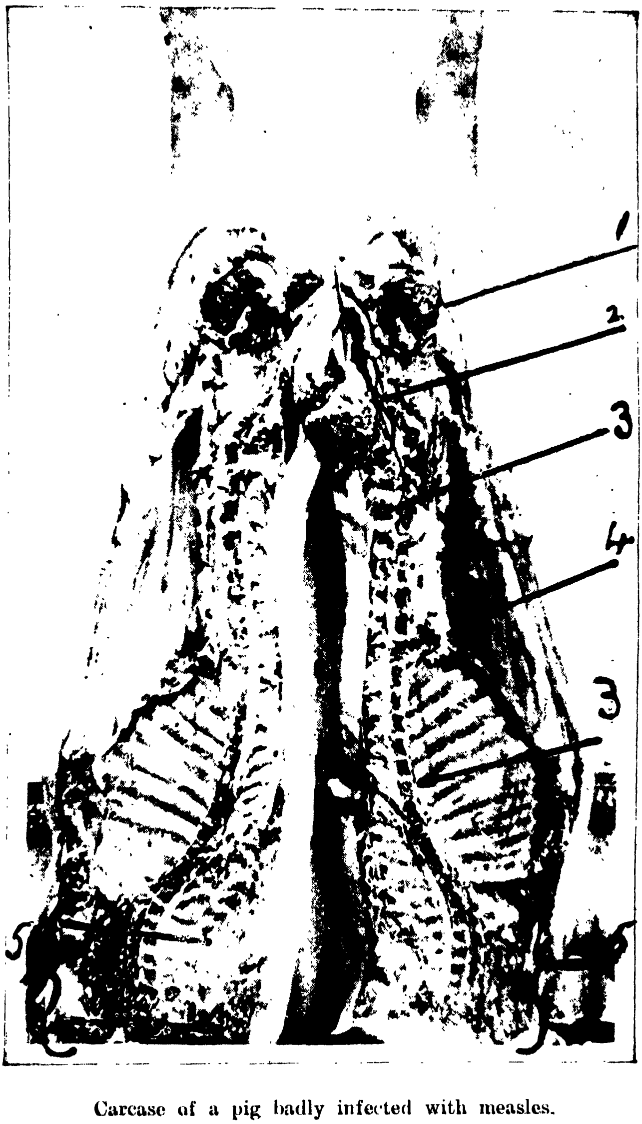
No. 1. Proper sanitary arrangements for human beings.

No. 2. Meat inspection and destruction of all infected carcases.

No. 3. Control of the feeding of pigs.

This control can only be successfully carried out if pigs are kept in sties and small paddocks, and under no circumstances are allowed to graze on the veld; also if care is taken to see that it is impossible for the food and water to be contaminated by sewerage.

The plate accompanying this article was taken from a photograph of a pig killed at one of the Salisbury bacon factories. The animal was cut in half, exposing the inner sides of the thighs, abdomen and chest, and also a division of the muscles of the neck; the heart will be seen suspended by a hook from one of the thighs. On examining the photograph closely it will be seen that numerous small white spots appear—



Carcase of a pig badly infected with measles.

(1) on the cut surfaces of the muscles of the thighs;
(2) on the heart;
(3) on the muscles between the vertebræ of the back;
(4) on the fillet;
(5) on the cut surface of the muscles of the neck.

These are all cysts of the *Tœnia solium*. This carcase was the most extensively infected one that I have ever seen.

It is a remarkable fact that during life the presence of these cysts seems to cause the animal little or no inconvenience; the pig thrives and fattens as well as any other in the sty, and in support of this I may mention that on two occasions after I had inspected and condemned carcases for measles I was informed that these carcases had both taken prizes in their respective classes at shows a week before as prime bacon pigs.

Advertising Southern Rhodesia.

The following publicity programme has been provisionally arranged by the High Commissioner for the present year:—

Date.	Exhibition or Show.	To be held at
May 4-16.	Empire Marketing Board Shop.	Birmingham.
25-27.	Empire Exhibition.	Cheltenham.
29-31.	Empire Exhibition.	Glasgow.
June 1-13.	Empire Exhibition.	Glasgow.
3-6.	The Royal Counties Show.	Portsmouth.
23-26.	The Highland Show.	Edinburgh.
July 1-4.	Aldershot Show.	Aldershot.
7-11.	The Royal Show.	Warwick.
22-24.	The Royal Welsh Show.	Llanelly.
Sept. 21-26.	International Grocers' Exhibition.	London.
	Empire Marketing Board Shop.	Liverpool or Manchester.

Plant Pathology in Southern Rhodesia during the year 1930.

By J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.,
Government Plant Pathologist.

The number of specimens received and reported upon during the year totalled 332. This is 95 less than in the previous year, which may be accounted for by the greater familiarity of the farmers with diseases, especially those of tobacco, of which the number of specimens submitted has been greatly reduced. Sixty-four parasitic diseases have been recorded for the first time—fifty-five on economic plants and nine on indigenous; this is an increase of three on the previous year's new records. Determinations have taken up considerably more time owing to the better-known diseases having already been named. Each year the investigation of unrecorded diseases involves more and more experimental work, so that many whose causes are suspected have had to be discarded owing to lack of time for complete study. Ninety-eight specimens of different diseases (including a new rust, *Uromyces rhodesica* Wakef. sp. nov. on *Bauhinia*) have been added to the herbarium during the year.

Sixty-six farms have been visited. This is sixty-one less than last year, the decrease being accounted for by increased laboratory work. Extension and advisory duties must be curtailed until such time as additional staff is provided for the branch. Thirty-three visits were paid to Government experiment stations for the purpose of superintending experiments.

The following articles were published in the *Rhodesia Agricultural Journal*:—

1. Mycological Notes: "Further Experiments on the Control of White Mould (*Erysiphe cichoracearum* DC.) of Tobacco." April.

2. Mycological Notes: "The Diplodia Menace." May.

3. "A List of Plant Diseases occurring in Southern Rhodesia." April, May and June.

4. "Field Control of Frenching in Tobacco." June.

5. "The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases." November.

The following paper has been accepted for publication in the Transactions of the British Mycological Society:—

"*Alternaria gossypina* (Thüm) comb. nov. Causing a Leaf Spot and Boll Rot of Cotton."

A handbook on tobacco diseases in Rhodesia, which will include six full-page, coloured plates and 38 illustrations, has been compiled, and is now in the hands of the printer.

A larger exhibit than heretofore was placed on the Salisbury Agricultural Show.

CROPS.

Tobacco.—As usual, climatic conditions to a large extent influenced the appearance and severity of diseases. Hot, dry weather in February effectively checked bacterial diseases, so that few cases of severe damage from angular spot (*B. angulatum*) or wildfire (*B. tabacum*) were recorded. White mould (*Erysiphe cichoracearum*) was destructive in some areas, but the heavier types of tobacco now being grown, such as Orinoco White Stem, Warne, etc., and the increased "body" in the leaf appear to offer resistance to the disease. The wider adoption of "priming off" the lower leaves in order to increase leaf weight, etc., is probably responsible for much of the control, for, where very heavy vegetative growth prevents aeration of the field, infection is generally found to be severe.

The late rains which occurred in March after a prolonged drought, during which time plants had mostly been "topped," were responsible for severe outbreaks of red rust, and later frog-eye (*Cercospora nicotianæ*), the latter being particularly severe on the late maturing crops.

A close study in the field was made ot red rust, and there appears to be little doubt that it is a physiological disease resulting from a sudden absorption by the plant of nutritive material (particularly nitrogen) from the soil, the normal outlet for which (*i.e.* growth) is interfered with by the operation of "topping." Judging by the dark bluish-green appearance of the leaves just before spotting occurs, it would seem that the plants are suffering from the presence of excess of nitrogen. Experiments have been planned to test this theory.

Success has been obtained with the measures advocated for the control of Mosaic, particularly in regard to the washing of labourers' hands when working on the seed beds, and, later, "priming" in the lands.

Observations go to show that with very heavy leaf, such as that of the Western variety, the normal mottling caused by Mosaic is masked. Instead, a severe white spotting occurs which may spread over the whole of the leaf, rendering it quite valueless.

Outstanding examples of the possibilities of Mosaic control may be seen in the Shamva area, where great care is taken to prevent infection in the early stand.

In the laboratory certain diseases associated with the genus *Alternaria* have been studied closely, and a new classification has been made of three species. In the same way, two species of *Phyllosticta* have been delineated; full descriptions of this work appear in the technical appendix to the handbook shortly to be published.

Maize.—A study has been made of seedling diseases. The position in Rhodesia appears to be much the same as in other maize-growing countries. Death of young seedlings has been found to be due to species of *Penicillium*, *Aspergillus* and *Rhizopus*, as well as to *Diplodia zeæ* and *Giberalla saubinettii*. The first three are not usually serious under field conditions, although *Rhizopus*, probably *R. nigricans*, has been known to cause severe losses on certain lands.

Seed treatment with Tillantin R has given satisfactory results throughout the Colony, but the idea is still prevalent that this operation will entirely control ear rots. It must be realised that seed dressings only act as a protection to

the young seedling, and that strict field sanitation on a wide scale is necessary for the reduction of losses from *Diplodia*.*

The life history of *Diplodia zeæ* has been studied in the field. It appears that under Rhodesian conditions early infection of the leaf sheath takes place, and a certain quantity of spores is produced on the affected areas before pollination takes place. If good light rains are experienced at the time of "tasselling," thus ensuring a high percentage of fertilisation, then infection of the cob by way of the "silks" is also found to be high. The mid-season spell of hot, dry weather, which is normally experienced, appears to check to some extent the rapid advance of the fungus, so that if heavy later rains do not occur, then the disease is confined almost entirely to the tips of the cobs. Under these circumstances the cobs do not fill out, and a light crop is reaped. If, however, good rains are experienced in March, then the crop is heavy, but the amount of discoloured grain is proportionately large. It will be seen, therefore, that conditions favourable for maize growing will also favour the development of *Diplodia*. This fact again emphasises the need for the destruction of trash, which is responsible for primary infection early in the season. A variety reported to be resistant to *Diplodia* is being tested this season.

Cotton.—A disease due to *Alternaria gossypina* has been investigated. Its more serious phases are a rot of young bolls and the extension of angular leaf spot (*B. malvacearum*) lesions, which may seriously affect the leaf surface of the plant. Results have been embodied in a paper now awaiting publication.

Angular leaf spot and bacterial boll disease are widespread; the black arm phase has not, however, been in evidence. Preliminary seed treatment trials for the control of this disease have been laid out at the Gatooma Cotton Station by kind permission of the Cotton Specialist.

Citrus.—An investigation has been made of fruit rots under conditions of local cold storage. Selected culls kept well, but inferior fruit broke down relatively rapidly due

* *Diplodia* is the name used locally to signify all seed-borne diseases.

to infection by blue mould (*P. italicum*) and sour rot (*Oospora citri aurantii*).

Potatoes.—The degeneration of imported seed has been followed through four successive plantings. It appears that high temperatures bring out the Streak virus, which is normally carried by the Up-to-Date variety.

OTHER DISEASES.

Several isolations of Phycomycetous fungi, including *Phytophthora parasitica* on *Antirrhinum*, *Pythium ultimum* on *Cupressus* seedlings and *Phytophthora parasitica* on rhubarb, constitute the first records of this group in Rhodesia. Very great difficulty is experienced in the technique of isolation, and this may account for failure in the past to detect these organisms.

Other important diseases newly recorded during the year include *Rhizopus nigricans* boll rot and *Alternaria macrospora* leaf spot of cotton; *Physoderma zeæ maydis* on maize; *Verticillium* sp. wilt, ring spot virus and *Oospora* sp. must, of tobacco; *Corticium salmonicolor* on apple and pear; *Uromyces appendiculatus* on bean; *Erysiphe polygoni* on cowpea; *Macrophomina phaseoli* (*Rhizoctonia* stage) and *Helicobasidium purpureum* (*R. crocorum*) on soya bean; *Penicillium* sp. rot of tea seed; *Ustilago cynodontis* and *Phyllachora cynodontis* on *Cynodon dactylon*; *Erysiphe cichoracearum* on *Aster*, *Calliopsis* and *Leucas; Bacterium tumefaciens* on rose; Mosaic of *Datura stamonium* and a *Cercospora*, morphologically indistinguishable from *C. gossypina*, on *Hibiscus*.

FIELD EXPERIMENTS.

Tobacco.—Experiments for the control of white mould (*Erysiphe cichoracearum*) were continued for the third year. The disease did not develop to any great extent, so that results were somewhat unsatisfactory. Single plant counts, however, showed that small applications of sulphur to the soil were useless, but that if made in conjunction with "priming off" of lower leaves, then good control could be obtained. "Priming" alone gave a decided check to the disease.

The control of Frenching by applications of nitrogenous fertilisers has been described in the *Rhodesia Agricultural Journal*.

Control of angular spot was obtained by severe "priming" of one month old plants and then spraying with 4-4-50 Bordeaux mixture.

Maize.—Trials of various fungicidal seed dressings gave inconclusive results. Previous experiments have shown the beneficial effects of these substances on the germination of infected seed and subsequent stand, so that this season's trials were carried out with very carefully selected seed (which could be considered to be disease-free) to which had been added 10 per cent. of very slightly-infected grain. Plots were replicated six times.

Approximately 4 per cent. increase in yield was obtained with Tillantin R and 3 per cent. with Abavit B dusts, but a decrease of 0.5 per cent. occurred with Uspulun soak. The results emphasise the primary importance of the selection of disease-free seed in the control of seed-borne diseases, but, as such perfect commercial samples are almost unobtainable in the Colony, the use of fungicidal dressings is still recommended.

In conclusion, I wish to express my thanks to those officers of the Department whose co-operation has been obtained in the work here recorded.

AT STUD.

The Training of Pointers and Setters.

(Concluded.)

By DUNCAN K. SMITH.

Persist in your efforts to maintain correct ranging and quartering, and always give the signal for any change of direction. Teach your dog to answer to the signal until it is possible to get him to work any given piece of ground to your front or flank by signal. It may be necessary for the trainer actually to walk over the ground that he wishes the dog to work several times, with many changes of direction and many signals. This may prove a rather trying part of the training, but once the dog "grasps the idea" he never forgets it, so that a little extra trouble here will be justified, in that in future hunting it will save the trainer many journeys to likely-looking cover, etc., to either flank if the dog can be directed to work it by signal.

Check any tendency to run-in immediately and every time the mistake is made. Try to anticipate any wrong move, and give the order to correct it before it has actually happened.

Should your dog chase any game and remain away for a considerable time, make it plain that you are displeased, but do not thrash him when he returns. It is of very little use punishing a dog for any misbehaviour unless he can be caught in the act more or less.

If your dog is taught to retrieve, and he runs-in and returns with the game, do not punish him, as the punishment will be connected with the "retrieve" and not the "run-in." Should this happen, bring the check-cord into action, when he can be shown where his fault lay. Do not allow your dog to retrieve any game to which he has not behaved well.

Should there be any difficulty about getting your dog to "back" another pointing dog, attach the check-cord to his collar and allow him to work with the cord trailing. As soon as game is "marked," the end of the cord can be secured by the trainer or assistant and the dog brought up to the correct backing position and held there while the game is worked by the dog which first pointed.

Should your dog be trained to "point dead," insist that he does so; do not allow him to get into the habit of "mouthing the game."

It is hoped that those sportsmen who have been interested enough to follow these notes will make an effort to attend the next local field trials.

The trials are held each year conveniently near Salisbury where game is known to be plentiful. They are run usually on a Saturday afternoon and Sunday. The spectators and competitors generally camp out, and a most enjoyable week-end ensues. All sportsmen are welcome, either as competitors or spectators, and some very fine work is usually seen. Many useful tips can be gathered, and any questions gladly answered by those who have had considerable experience in training, and every assistance given to the less experienced in every way.

Particulars of the trials and dates of meeting will gladly be furnished on request by the writer.

Hints to Poultry Keepers.

THE BREEDING STOCK.

Issued by the POULTRY BRANCH.

All poultry breeders wish good hatchable eggs with strong germs and chicks easy to rear. The point is how to produce these. It is a matter of common sense and care. To lay well, a bird must eat well, and to lay good hatchable eggs, she must have good quality food. Cheap feeding and inferior foods mean poor hatchable eggs and weak chicks. The breeding bird must have plenty of green succulent food, and foods containing a good percentage of mineral salts must be given. She must not be forced for eggs. The hen that gives ten strong chicks from every twelve eggs put down, eight of which reach maturity, is the one to breed from; not one which gives only six chicks from every twelve eggs, two of which only can be reared to maturity. The former, provided she has a good egg record behind her, is the one to be the mother of the stock cockerels.

All birds that are going into the breeding pens should have free range if possible and good comfortable houses. They should be kept just laying; we do not want too many eggs from the breeding hens. Free range will be productive of fewer eggs, but they will be better hatchable ones than those from birds kept under the intensive system. Birds intended for breeding should never be coddled when young, and they must always be strong and healthy from the day they are hatched. Strong, vigorous birds that have been good layers should be kept as long as they produce good fertile eggs and robust chicks.

The breeding pen should be in a sheltered place, but not a close, stuffy one. Good hatching results will never

be obtained if the breeding birds are exposed to wind and rain, with no shelter. There is nothing like wind sweeping over the ground to cause infertility and bad hatching and rearing. Never mate a cock bird three years old to hens three years old and over; if the latter are three or four years, or even more, the male bird must be a young vigorous male; you can have age only on one side. You can breed from hens even in their third and fourth years, provided they have been good layers in their first and second years, strong and healthy and their eggs hatchable and germs strong. Breeding stock must on no account be forced. They must not have too much animal protein and should be fed on more grain than mash. They should be kept free from excessive internal fat. Scratching exercise they *must* have.

It is better to mate early and allow six or eight weeks to elapse before the first eggs are set; you are then likely to get more pullets than cockerels. If the first eggs are set a few days after mating, the cockerels are likely to predominate for the first two or three months. Highly strung, squalling hens should never go into the breeding pen; for best results, contented, quiet hens and those that are happy and agree should be used and kept in a quiet spot.

The birds, including the male, must be kept free from insects, otherwise poor laying, infertile eggs, weak germs and chicks will be the result. Birds that are over-fat or very thin are more subject to lice than those that are not so, and remember that a louse can be a grandfather in 24 hours.

Export of Hides and Skins.

The export of hides and skins from the Union of South Africa and certain adjoining territories has been brought under control as from the 1st February, 1931.

The regulations governing the export of hides (cattle) and skins (sheep and goats) are set forth in the Union of South Africa *Gazette* Notice No. 1941 of 24th October, 1930.

A short summary of the more important regulations is given below for the information of Rhodesian exporters.

1. These regulations shall apply to hides and skins which originate in the Union of South Africa, Bechuanaland Protectorate, Swaziland or Basutoland. Hides imported from other territories shall be shipped separately.

2. From and after 1st February, 1931, hides and skins intended for export shall be subject to inspection.

3. An inspector has the right of free access to places where hides or skins are stored, and may open up bales for the purpose of inspection.

4. Each bale of hides or skins for export must carry the distinguishing mark of the exporter registered with the Department of Agriculture.

5. Each bale of hides shall be secured with rope or iron bands.

6. Each weight, class and each selection or assortment of hides or skins shall be packed and marked separately.

7. The number of hides or skins contained in each bale shall be clearly marked thereon.

8. All dry or dry-salted hides or skins shall be shipped in a well-dried condition.

9. "Re-cured" hides or skins shall be prohibited from being exported from the date these regulations take effect.

10. "Pitted" or "pickled" hides and skins shall be prohibited from being exported from the date these regulations go into effect.

A range of weight limits for hides and skins of various classes is laid down, and provision is made for the payment of an inspection fee.

Farming Calendar.

April.

BEE-KEEPING.

The notes given for last month will in the main apply to April also, according as to how the season develops. New swarms are not recommended to be hived during this month unless they are supplied in the first instance with fully drawn out frames and the owner is prepared to feed them now and again during the winter. As April should be a very active month for the bees, watch carefully the progress of the crates in which surplus honey is being stored, and have plenty of frames—fully drawn out if possible—ready fixed with foundation so as to place on extra crates as occasion may require; these should be placed under the full or filling one and not on the top, as might appear the case. For the benefit of those who would like a little honeycomb, it might be stated that if two or three shallow frames are fitted with four empty comb sections, and placed in the crate, the bees will take to this plan and so provide both comb and honey for extraction in the one crate. In this African climate full crates can be left on the hive with safety until ready for extraction, but if any are taken off they must be watched now and again until they are extracted for damages from the wax moth, which in a day or so can ruin both the comb and honey.

CITRUS FRUITS

During the first half of this month, autumn budding can still be performed if the sap is still up and the bark of the stock slips freely. Unprofitable and off type trees that have been headed back for top working and which have been carefully thinned out may have the shoots on which February-March buds have failed re-budded to profitable varieties. If the March rains have been sufficient and ploughing and cultivation have been completed, continue cultivation to retain soil moisture and destroy winter weeds. If a dry March has been experienced and cultivation has been badly performed, irrigation should be commenced or continued to keep the trees and fruit in good order. If not already applied to the unthrifty trees which are late with their autumn flush, soluble fertilisers containing nitrogen and phosphoric oxide can be applied with advantage to these trees. The fertiliser should be worked into the soil with a cultivator and followed up with an irrigation. Exporters should have everything in readiness for packing the early fruit, which should be fit to market about the end of the month. Scale infested fruit will be unfit for export unless treated at once. See entomological notes for treatment.

CROPS.

If sufficiently mature, begin cutting and stooking early maize over a small acreage and plough up the ground whilst still damp between the rows of stooks. If ripe, reap and husk early planted maize, and keep in a separate dump. Continue to make field selections of the best maize plants, and mark those required for seed with strips of coloured cloth. Lift any ground nuts and potatoes showing signs of making second growth. Make silage; cut maize for this when the ears are in the "dough" stage. Pick up and stook maize plants blown over to protect the ears from white

ants. Feed sweet potato vines to stock, reserving any new growth of vines for feeding as grazing in May. Plough in any green manure crops not already turned under. Plough fallowed land. Keep potatoes reserved for seed on racks in a cool place protected from frost, but well ventilated. Transplant onions from seed-beds to irrigated or naturally moist lands; irrigate about once a week, but do not apply too much water. Pick over potatoes which may be lifted, and remove the bad and diseased ones. Winter cereal crops for grain can be sown towards the end of the month. Cart manure to the lands. Remember that good and deep ploughing to a depth of at least 7 to 8 inches is essential, and the basis of all successful arable farming. If the lands are not already ploughed so deep, increase the depth of ploughing about an inch a year until this depth, or even more, is reached. On lands which have been ploughed for a number of years at the same depth, use a grubber to stir up the sub-soil without lifting it to the surface. Too much attention cannot be paid to good tillage. It is usually good practice to follow the plough at once with a harrow or other suitable implement to break down the clods before they bake hard. Continue breaking up new lands; the earlier this is done the more complete is the decomposition of the vegetable matter in the soil. When making hay of coarse legumes such as velvet and dolichos beans and cowpeas, be sure that the vines are dry before stacking. Handle the hay as little as possible to avoid loss of leaf. Thought should be given to laying in supplies of thatching grass for thatching and repairing roofs. The veld may be beginning to dry off. Consideration may be given to mowing or otherwise preparing fire lines as a preventive against veld fires.

DAIRYING.

At this season of the year the milking kraal is generally far from clean owing to the excessive amount of mud or dust which has accumulated during the latter part of the rainy season, and in consequence farmers invariably have trouble in producng first-grade cream. Every endeavour should be made to erect a small milking shed in which four or five cows or more can be milked at a time, and every effort should be made to keep the cows clean. The udders should be wiped before milking with a clean, damp cloth, and the farmer should see that the natives' hands are washed with soap and clean water before and after each milking.

If butter is made, the cream and washing water should be put out overnight, and if the cream is churned early the following morning, very little difficulty should be experienced in obtaining a good grain and a firm body in the butter.

From this time of the year onwards, cheese making operations are usually most successful. The evening's milk should not be kept in the dairy, but should be placed outside, preferably in a bath, and covered over with butter muslin, cheese cloth or mosquito gauze netting. Care should always be exercised, however, in using evening's milk. Morning's milk plus a starter usually gives the best quality, and if a starter is used, care should be taken that it shows no signs of gasiness or off flavours.

The season of abundant green pasture is over, and the natural grazing, unless supplemented by some green food or succulent roughage, is not sufficient to maintain a full flow of milk. The most economical supplement to veld grazing at this time is maize silage, and this should be fed in liberal quantities to all milking cows and growing stock. A few pounds of concentrates in addition would also be of great benefit to the milking cows, which should not be compelled to subsist entirely on veld hay and silage.

DECIDUOUS FRUITS.

If not already done, orchards should be ploughed, harrowed and well cultivated to retain the soil moisture for spring blossoming and growth. Varieties such as the Chinese peaches, etc., may be pruned after the leaves have dropped.

Order all trees for winter planting during June-July. August planting is unsafe for many early growing varieties of fruits.

All late apples should be harvested and stored or marketed.

ENTOMOLOGICAL.

Maize.—Although certain pests, such as earworm and stalk borer, may be in evidence, there are practically no operations against insect pests that can be carried out economically during this month.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt. Watch should be kept for the emergence of the adult wireworm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20-30 gallons of water. The bait should be rolled into a small ball and scattered on the lands, one ball to each 10 square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 8 lbs. per 10 gallons. The bait is best laid in the evening.

Cotton.—Damage to bolls from bollworms may be noticed by the flaring of the bracts and the dropping of the bolls. All dropped bolls should be collected and destroyed. Guinea-fowl, turkeys, etc., may be encouraged to destroy stainers, etc. Stainers should be trapped in traps of cotton seed or trash and destroyed.

Citrus.—Collect and destroy infested fruit to keep down citrus codling moth. Red scale should be destroyed by fumigation with hydrocyanic acid gas or with resin wash. Soft brown scale may be controlled with resin wash. It will be controlled by fumigation with hydrocyanic acid gas where this is practised against other scale insects. Aphis may develop on young growth and may be kept down by spraying with nicotine or home-made tobacco wash.

Vegetable Garden.—Plants of the cabbage variety are liable to suffer severely from cabbage louse and Bagrada bug. The former can be kept largely suppressed by frequent washings with a strong spray of cold water or with a nicotine spray. Bagrada bug is more difficult to control. Crude carbolic emulsion, 1 part in 15 parts of water, or resin wash gives partial control. The spray must hit the insect to kill. Do not re-plant a cruciferous crop (cabbage family) on the same plot. Thoroughly clean and work the soil.

Potatoes.—Potatoes should be cultivated systematically and hilled up to keep the tuber moth from the tubers.

FLOWER GARDEN.

The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily

managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

Cultivate the soil in the young plantations either by means of machines or hand labour. The cultivation will conserve moisture. Hoed out weed growth should be applied as a mulch round the base of each young tree. Be careful not to pile earth round the stems of the young trees. Covering the stems with earth even for an inch or two interferes with sap circulation and invites attacks by termites.

Prune the young trees to single stems. Any exceptionally strong undesirable branch growth may be checked by breaking off the leading shoot, but ordinary branch growth should not be touched.

POULTRY.

The first chicks should now be out, and these, having been hatched, must be well looked after. No food should be given for the first 36 to 48 hours. Leave them to sleep as much as possib'e. See that they have plenty of fresh warm air, but are not exposed to draughts. After 48 hours give some small grit and charcoal to purify the intestinal tract and aid digestion. A pamphlet dealing very fully with incubation and rearing of chickens can be obtained gratis on application to the Poultry Experts, Department of Agriculture.

One comes across many cases of wrong treatment of chickens in this country, the chief being uncleanliness, over-crowding, giving food too early and dirty drinking water. Two most important foods are animal protein, especially in the form of thick separated or whole milk and green food, especially onions or eschalots or their green tops. The loss in the rearing of chicks is very great; this should not be so if good breeding stock is used, the eggs from these are carefully handled and incubated and the chicks reared with care and common sense.

Any turkey chicks hatched at this time of the year should be well looked after. They should be kept warm, dry, free from insects, fed on dry food only, given plenty of thick separated milk, onions or onion tops, dry mash and grain. A pamphlet on turkeys and turkey rearing is obtainable gratis from the Poultry Experts.

Ducks should do well during the month, the weather being as a rule cool, moist and bracing; but the houses in which they sleep must not be damp. Duck breeders should always be on the "qui vive" for a round worm called "Trichosoma contortum," which is often fatal to ducks. It is found in the œsophagus, and causes arrest of growth, emaciation and weakness and sometimes epileptiform attacks. A swelling will be noticed at the lower part of the neck, which rapidly increases in size, and death occurs in one to three days. Onions, or preferably garlic, mixed with the food is a good preventive and cure. Another good remedy is essence of turpentine mixed with twice its quantity of olive oil and one or two tablespoonfuls given for a dose.

TOBACCO.

The grading of the brighter grades should be proceeded with as soon as convenient. All leaf which has cured green should be bulked separately and be regularly examined to avoid serious damage through overheating. Tobacco seed heads, when mature, should be removed from the plants and stored where no damage will occur through activities by rats and mice. Care should be taken to store these seed heads with the pods uppermost, as otherwise much seed may be lost. Clear and plough the land soon after the crop has been harvested. Burn old stalks as a control measure against possible carry over of disease.

May.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feed liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level. The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Finish transplanting onions from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards

end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias

and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—Ranching cattle may still be expected to be in good condition. In most districts it will be wise to conserve hay, maize stover, ensilage

and a supply of any other cheap feed as a provision against possible late rains in the spring, and to enable one to maintain the younger or very old stock should occasion arise. By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies and care taken that they are clean and sufficient.

Sheep.—If the vleis have dried, sheep may be allowed into the lower lying veld. If the rams are put in now, lambs will arrive in October, which is usually a good month to arrange for. Those who favour winter lambs and have ewes lambing now will find a few handfuls of maize, together with chopped maize stalks or any other kind of available roughage or green stuff, a great help to the ewes in providing milk.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

Southern Rhodesia Veterinary Report.

January, 1931.

TRYPANOSOMIASIS.

Nine cases with two deaths in Melsetter district, eighteen cases and two deaths in Hartley district and four deaths reported in Lomagundi district.

HORSE-SICKNESS.

The following mortality was reported: Hartley 2, Sinoia 1, Charter 4, Inyanga 1.

CUTANEOUS MYIASIS (SCREW WORM IN CATTLE).

Numerous cases reported in Insiza, Plumtree, Mazoe and Makoni districts, and a few only in several other districts.

SWEATING SICKNESS IN CALVES.

This disease has been notified from many farms.

QUARTER EVIL.

Very few outbreaks notified.

SCAB.

One outbreak in Melsetter district and one in Gwelo.

IMPORTATIONS.

From the Union of South Africa: Bull, 1; cow, 1; heifers, 11; horses, 7; mules, 4; donkeys, 83; sheep, 2,587; goats, 150; pigs, 14.

EXPORTATIONS (CATTLE).

To the Union of South Africa: For local consumption, 120. To Belgian Congo: Slaughter, 1,381; breeding, 1,383. To Northern Rhodesia: Slaughter, 626; breeding, 267.

EXPORTATIONS (MISCELLANEOUS).

To Union of South Africa: Pigs, 40. To Belgian Congo: Sheep, 62; pigs, 248. To Northern Rhodesia: Sheep, 227; goats, 14; pigs, 203.

EXPORTATIONS IN COLD STORAGE.

Carcases: Beef, 321½; veal, 4; sheep, 35; pigs, 10. Livers, 200; tongues, 160; hearts, 150; brains, 100; tails, 210; tripes, 247; heads, 10; plucks, 12; cheeks, 50.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

FEBRUARY, 1931.

Pressure.—Barometric pressure was uniformly high during the month, amounting to about 0.025 in. above normal.

The equatorial low extended to the south on the 3rd, and affected Rhodesia directly on the 4th and 5th. It weakened slightly on the 6th, but deepened on the 7th, and on the 8th the whole of South Africa was under its influence; on the 9th it withdrew in the south, but returned on the 10th, withdrawing from Rhodesia. On the 11th it had withdrawn considerably. It remained on the west coast until the 15th, when it deepened and extended to the south-east coast, withdrawing on the 16th. A southerly low appeared on the 17th and moved round the coast without affecting the equatorial

low appreciably. A southerly low appeared on the 27th, and on the 28th was on the south-east coast.

A weak high appeared on the south coast on the 2nd. A fast-moving high appeared on the west coast on the 11th, and was off the east coast on the 12th, remaining in position until the 15th. A high was established on the 17th on the east coast, and remained there with minor fluctuations until the 28th.

Rain Periods.—Rain was general on the 1st, and fairly general from the 2nd to the 8th. The period then fell off, and isolated showers were recorded up to the 14th. On the 15th showers were numerous in the north. Showers were again recorded in the north and east from the 19th to the 27th, and isolated showers on the 28th.

Rainfall.—The average rainfall for February amounted to 3.6 inches—a little more than half the average.

The distribution was as follows:—

	February, 1931.	Average, February.	Per cent.
Zone A	1.9	4.9	39
Zone B	1.3	3.8	34
Zone C	3.8	6.9	55
Zone D	7.0	7.1	99
Zone E	5.2	6.5	80
Zone F	6.2	10.3	60

The rainfall from the 1st October is 19.0 inches, as compared with an average of 22.9 inches.

FEBRUARY, 1931.

Station.	Altitude	Pressure 8 a.m.	Temperature ° F. Absolute.		Temperature ° F. Mean.			Temperature ° F.	Humidity, 8 a.m.		Precipitation.		
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min.	Diff. from Normal.	Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
Bulawayo ...	4,440	867.9	91.0	59.0	84.0	61.8	72.9	+2.3	64.1	71	1.71	−2.4	4
Gwelo	4,632	862.2	89.0	55.0	81.6	60.4	71.0	+1.3	63.6	78	7.02	+1.7	8
Riverbank ...	4,100	...	98.0	58.0	90.4	61.7	76.0	+2.8	65.6	61	.53	−4.0	5
Essexvale ...	3,828	...	99.0	57.0	88.2	63.0	75.6	+3.4	66.4	80	3.11	−2.2	8
Gwanda ...	3,235	905.9	96.0	58 0	87.3	64.1	75.7	...	66.2	69	1.67	−2.1	4
Mazunga ...	1,970	...	...	...	...	...	...	...	...	...	...	...	...
Nuanetsi ...	1,630	...	...	...	...	...	...	...	...	...	...	...	...
Between Rivers	3,970	...	...	...	...	...	...	...	...	...	...	...	...
Enkeldoorn ...	4,720	...	87.0	54.0	81.9	60.1	71.0	+1.6	64.4	75	2.71	−3.3	8
Gatooma ...	3,850	...	95.0	57.0	89.2	61.0	75.1	+1.5	67.6	77	3.51	−4.1	...
Miami	4,090	...	...	...	...	...	...	...	...	...	...	...	...
Salisbury ...	4,865	854.6	85.0	57.0	80.6	60.6	70.6	+1.8	63.6	69	5.17	−0.5	12
Sinoia Citrus ...	3,830	...	87.0	59.0	84.1	63.0	73.5	...	67.2	77	3.47	−3.5	4
Sipolilo... ...	3,900	...	86.0	59 0	81.8	63.4	72.6	...	65.7	69	2.33	−5.0	11
Juliasdale ...	6,070	...	79.0	45.0	72 6	55.8	64.2	+0.9	61.0	76	6.98	−1.8	17
Mtoko	4,210	...	...	...	...	...	...	...	...	...	...	...	...
Shamva ...	3,170	...	...	...	...	...	...	...	...	...	...	...	...
Angus Ranch ...	2,300	...	97.0	64.0	88.8	69.4	79 1	...	71.5	77	2.14	−2.2	10
Craigendoran ...	3,000	...	90 0	61.0	85.4	64.4	74 9	...	69.1	80	6.65	+1.0	11
New Year's Gift	2,700	...	92.2	59.9	85.7	63.4	74.5	...	69.6	80	1.87	...	10
Nyamasanga ...	5,080	...	85.0	53 0	78.5	56.6	67.5	...	63.3	76	8.24	...	14
Riverdene North	3,700	...	93.0	54.0	85.0	61.0	73.0	−0.1	66.5	75	4.30	...	12
Stapleford ...	5,450	...	76.0	49.0	72.5	58.0	65.2	...	61.5	90	12.64	−3.3	18
Umtali	3,677	892.1	88.0	60.0	81.5	62.6	72.0	+0.5	66.9	80	4.61	−1.5	16
Victoria ...	3,570	896.0	89.0	57.0	82.3	62.3	72.3	+0.5	66.9	73	5.43	+0.7	9
Melsetter ...	5,060	850.3	82.0	54.0	74.8	58.4	66.6	+0.3	63.7	70	5.60	−3.4	13
Mount Silinda...	3,520	...	...	...	...	...	...	...	...	...	7.77	−3.9	11

Export of Cattle from Southern Rhodesia, 1931.

Month	Union		England.	Congo		N. Rhodesia.		Portuguese East Africa.		Total
	Slaughter		Slaughter	Slaughter	Breeding	Slaughter	Breeding	Slaughter	Breeding	
	Union of S.A.	I.C.S. for overseas	On hoof							
January ...	120	...	...	1,381	1,383	626	267	...	...	3,777
February ...	127	634	170	1,974	62	546	14	...	...	3,527
March ...										
April ...										
May ...										
June ...										
July ...										
August ...										
September ...										
October ...										
November ...										
December ...										

Notes from the "Gazette."

"Gazette" Date.	*Items.*
	POUND.
27.2.31.	A pound has been established on the Belingwe Native Reserve. (G.N. 146.)
	AFRICAN COAST FEVER.
	NATIVE DISTRICT OF MAZOE.
20.3.31.	Government Notice No. 191 releases the farms Grey, Mari Plumbi (Nos. 40 and 41), Moorfields, Bell Rock, Bally Hooly, Verona, Pasydia, Farm No. 33 and Mazamba from all quarantine restrictions.
	GAME AND FISH PRESERVATION ACT, 1929.
20.3.31.	Government Notice No. 10 suspends until further notice sections 3 and 6 of the above Act, and the shooting of elephants in the area defined below is permitted in and out of season, by day or by night, by hunters with or without a licence. Any profit accruing from the sale of ivory or the hides of the elephants shot will be the property of the hunter, but it will be necessary for him to furnish a sworn statement that the elephant was shot in the defined area, which is as follows:— An area in the Hartley district bounded by a line drawn from a point where the Umsweswe River crosses the western boundary of the Umsweswe River Block, along the western boundary of this block to the south-west beacon; thence in a straight line to a point on the Umniati River ten miles east of the railway bridge across the Umniati River; thence down the Umniati River to the railway bridge; thence northward along the railway line to the Umsweswe River; thence eastward up the Umsweswe River to the point first named.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only. Outside Southern Rhodesia, 3d. per copy.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 581. Leguminous Crops for Stock and Soil Improvement in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 591. Maize Export Conference Proceedings.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 601. Maize for Export, by S. D. Timson.
No. 603. The Production of Maize in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 684. Warning to Maize Growers: Maize for Export.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 724. Ploughing by Tractor, by A. W. V. Crawley, M.E., F.G.S.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 750. Cotton in Southern Rhodesia—Hints to Growers, by G. S. Cameron, Empire Cotton Growing Corporation.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld : Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea) : Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone- and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 777. Some Aspects of Cost of Production Studies in Agriculture, by Arthur G. Ruston, D.Sc., Department of Agriculture, Leeds University.

No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 783. Agricultural Costings at the Gwebi Farm—Fattening for Beef, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.

No. 794. Some Further Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
Botanical Specimens for Identification.
Accelerating the Sprouting of Potatoes.
Further Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron, Cotton Specialist.

REPORTS ON CROP EXPERIMENTS.

No. 94. Second Report on Experiments, by J. H. Hampton.
No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
No. 239. Reports on Crop Experiments, Gwebi, 1915-16, Part I., by E. A. Nobbs, Ph.D., B.Sc.
No. 246. Report on Crop Experiments, Gwebi Farm, Season 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
No. 342. Rotation Experiments, 1913-19, by H. G. Mundy, F.L.S., and J. A. T. Walters, B.A.
No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-20.
No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.
No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.
No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.
No. 437. Annual Report of Crop Experiments, Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.
No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 485. Annual Report of Experiments, 1922-23, Agricultural Experiment Station, Salisbury, by J. A. T. Walters, B.A.
No. 486. Bulawayo Experiment Station, Annual Report for Season 1922-23, by H. G. Mundy, F.L.S.
No. 514. Bulawayo Experiment Station Report, 1923-24, by H. G. Mundy, F.L.S.
No. 519. Annual Report of Experiments, 1923-24, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.
No. 537. Crop Rotations on the Gwebi Experiment Farm, 1923-24, by H. G. Mundy, Dip.Agric., F.L.S.
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No. 566. Bulawayo Experiment Station, Annual Report for Year 1924-25, by H. G. Mundy, Dip.Agric., F.L.S.
No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.
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No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
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No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.
No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.
No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
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No. 800. Bulawayo Municipal Experiment Station: Report for the Season 1929-30, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 806. Gwebi Demonstration Farm, by the Chief Agriculturist.
No. 810. Gwelo Municipal Demonstration Station: Annual Report, 1929-30, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

TOBACCO.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
No. 607. Tobacco Seed Beds, by D. D. Brown.
No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.
No. 617. Dark Fire-cured Tobacco, by E. M. Matthews, B.Sc., Tobacco Adviser. Fire-curing Tobacco Barn, by the Tobacco Advisers.
No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
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No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
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No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
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No. 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.
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No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.Sc. (Agr.), Tobacco Adviser.

STATISTICS.

No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
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No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
No. 361. Statistics of Live Stock and Animal Produce for the Year 1919, by F. Eyles, F.L.S.
No. 380. Statistics of Crops Grown by Europeans in Southern Rhodesia, 1919-20, by H. C. K. Fynn.
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No. 426. Statistics of Live Stock and Animal Products for the Year 1921, by H. C. K. Fynn.
No. 484. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1922-23, by A. Borradaile Bell.
No. 527. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1923-24, by A. Borradaile Bell.
No. 543. Statistics of Live Stock and Animal Products for the Year 1924, by A. Borradaile Bell.
No. 580. Statistics of Summer Crops Grown by Europeans in Southern Rhodesia for the Season 1924-25, by A. Borradaile Bell, Statistician.
No. 595. Statistics of Live Stock and Animal Products for the Year 1925, by A. Borradaile Bell, Statistician.
No. 626. Statistics of Summer Crops Grown by Europeans in Southern Rhodesia for the Season 1925-26, by A. Borradaile Bell, Statistician.

No. 646. Statistics of Live Stock and Animal Products for the Year 1926, by A. Borradaile Bell, Statistician.
No. 682. Agricultural Returns for 1926-27: Preliminary Returns, by Thomas G. Gibson, Government Statistician.

LIVE STOCK.

No. 227. An Experiment in Beef Production, by R. C. Simmons.
No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
No. 336. Butchering and Flaying.
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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Sunn Hemp.—This legume is rapidly becoming the premier green manuring and weed smothering crop in this Colony, and the illustration on the opposite page depicts a wonderful growth at Mr. George Rattray's farm, Kingston, in the Bindura district, being ploughed under with a disc plough drawn by oxen. The angle from which the photograph was taken rather distorts the height of the Sunn hemp, but from other photographs in our possession the crop was evidently standing two or three feet above the backs of the oxen, and owing to the tremendous growth the plough was unable completely to cover the crop.

Foot and Mouth Disease.—The regrettable outbreak of this disease is a serious blow to the pastoral industry of the

Colony. The immediate result is the disruption of the export trade in cattle, while the restrictions which it is necessary to impose on the movement of stock within our borders hamper and inconvenience the agricultural community in innumerable directions. Regrettable and disastrous as the presence of the disease is, especially at a time when we are developing an export trade in cattle of considerable promise, the position must be faced. That it will be faced with the fortitude and courage which has enabled us to surmount similar troubles in the past we have no doubt, and we feel sure that the farmers of the Colony will give the veterinary authorities their undivided support in eradicating the disease as early as possible. The public have been informed of the progress of events through the medium of the Press, and there is not much that we can add to what is already known. It will have been noted that the disease is of a mild type, and that it may run its course within a comparatively short while. We sincerely hope it will.

We publish elsewhere in this issue of the Journal a statement by the Chief Veterinary Surgeon describing the sequence of events which led to the discovery of the disease and the spread of the infection. To this we have added information from the same source published in the Press setting out the symptoms of the disease and such Government Notices as have already been issued on the subject.

Road Motor Services.—Bulletin No. 50, issued by the Rhodesia Railways, contains some interesting particulars relative to these services. There are now twenty-six services in operation, some running daily, others once, twice and thrice weekly to points ranging from 14 miles to as far as 180 miles distant. For instance, lorries run twice weekly between Umtali-Melsetter-Chipinga, Salisbury-Enkeldoorn-Umvuma and Fort Victoria-Beitbridge. The rates will be found in an advertisement which appears elsewhere in this Journal.

The services are still being run at a loss, although it is pleasing to note that the ratio of expenditure to revenue has slightly decreased. For the months of October, November and December, 1930, the total revenue was £10,537 and

the expenditure £13,674. Per mile, the revenue averaged 18.42d. and expenditure 23.94d. The total mileage of the lorries during the three months in question was 136,033, and the tonnage carried 7,001, plus 6,818 gallons of cream. The total mileage of the trailers was 41,477.

The Railway Administration is to be congratulated upon the establishment of an efficient and up-to-date service which is proving of the greatest benefit to the farming community.

The Citrus Industry.—The annual report of the Rhodesian Co-operative Fruit Growers' Association, Ltd., for the year ended 31st December, 1930, provides the information that 166,825 cases of citrus fruits were exported from Southern Rhodesia last year, of which 159,318 cases went to the United Kingdom. Prices were at a slightly higher level than in the previous year, thanks principally to the absence of Californian competition, but also to the improved system of distribution and the intensive advertising campaign promoted by the overseas office of the South African Co-operative Citrus Exchange. Of the total given, 131,362 cases were shipped at Capetown, 22,908 at Beira and 12,530 at Durban. The directors of the Association have continued to press for the establishment of cold storage facilities at Beira, but report that there is apparently no immediate prospect of securing these. As a result of representations by the Association extending over a period of years, direct refrigerated shipping services have been inaugurated between South Africa and Canada and Italy. To the Association must be given credit for making the first direct shipment of citrus fruit from South Africa to Canada, consignments last year amounting to 4,514 cases. It is stated that the fruit opened up satisfactorily and sold at favourable prices. We understand it is the intention to send further consignments of Rhodesian citrus fruits to Canada this season, and hopes are entertained that a profitable trade will be established between the two countries. The Association has for some time paid attention to the development of the smaller markets on the East Coast homeward route, as well as to the near and far East, with varying results. These markets are con-

sidered to hold out possibilities which will be further exploited this season.

At the annual general meeting of the Association held on the 18th March the chairman, Lieut.-Colonel T. E. Robins, expressed the opinion that the fruit export industry had probably suffered less than any other from the general trade depression prevailing throughout the world. Although no grower could claim to have made much money out of it in the last two years, if the prospects of improved trade conditions materialise he thought the fruit grower would be one of the first to benefit. He looked forward with every confidence to a more prosperous season this year.

Beef Cattle in the United States of America.—The total increase in cattle numbers in the United States between 1st January, 1928, and 1st January, 1931, was 3,279,000 head. Of this increase, 1,147,000 head, or 35 per cent., was in cows and heifers two years old and over kept for milk; 504,000, or 15 per cent., in yearling heifers being kept for milk; 591,000 head, or 18 per cent., in total calves; 758,000, or 23 per cent., in beef cows and heifers one year old and over; and 259,000 head, or 9 per cent., in steers and bulls. The increase of 591,000 calves was in calves other than those saved for milk cows. The total number of cattle on farms in the United States on 1st January, 1931, was 58,955,000 head.

Cattle imports into the United States totalled 232,000 head in 1930, compared with 505,000 in 1929. Of the 1930 total, 172,000 came from Mexico and 60,000 from Canada. Canned beef inspected for entry into the United States during 1930 amounted to 48,533,000 pounds, a decrease of 28,948,000 pounds, or about 37 per cent., from the total of 1929. Total imports of fresh and frozen beef during the first 11 months of 1930 were less than one-fourth as large as during the corresponding period in 1929, amounting to 9,266,000 pounds in 1930, compared with 41,840,000 pounds in 1929. This decrease was due largely to decreased imports from New Zealand. From 30th June to 30th November, 1930, only 1,905,000 pounds of fresh and frozen beef and veal entered the United States from all sources. According to the "Agri-

cultural Outlook" for 1931, issued by the United States Department of Agriculture, from which the above figures are taken, imports of cattle, beef and veal during 1931 are expected to be less than those for 1930, largely because of the import duties now in effect.

Cattle production in the United States has been increasing for three years, but the increase has been greater in dairy cattle than in beef cattle. It is thought that beef cattle production will continue to increase, but only so long as the returns from such cattle appear relatively favourable to those of alternative agricultural activities. The sharp drop in cattle prices in 1930 eliminated much of the price incentive to expand production, but some recovery from the present price level seems likely. The position is summed up in the "Agricultural Outlook" thus: "It is probable that during this next decade cattle prices will average relatively higher than the average prices of all agricultural products combined."

We note from the source just quoted that the gross income from agricultural production in 1930 in the United States is apparently less than that of 1929 by about 2,500,000,000 dollars, or 20 per cent. The general index of prices received by farmers for their products dropped from 134 per cent. of pre-war average in January, 1930, to 97 per cent. as of 15th December, 1930. Reference is made to reductions in the price of farm equipment, fertiliser and commodities in general, and the opinion expressed that agriculture stands to gain by the gradual stabilising of business and prices.

The Land and Agricultural Bank of Southern Rhodesia.—The Board report that during the year 1930 the number of applications received was 307 for advances aggregating £175,493, as against 358 for an aggregate of £234,988 for the preceding 12 months. The amount collected in interest during the year was £51,648, as against £68,339 due for collection for the 12 months, inclusive of arrears outstanding from previous years. The Board point out *inter alia* that it has been difficult to overcome the mistaken impression originally held by many farmers that because the

Bank was established by the Government the proper fulfilment of obligations arising under bonds would not be seriously pressed. In such circumstances it is now satisfactory to learn that there are comparatively few debtors who do not realise that it is essential to meet obligations to the utmost of their ability. This does not infer that the farmer debtor is treated harshly by the Board; on the contrary, we think it is probably well known that within the limits imposed by the Act constituting the Bank every consideration is given to farmers who may be in financial difficulty.

We note that during the year bonds bearing interest at 7 per cent. and upwards were taken over by the Bank to the value of £10,615, which brings the bonds in all now taken over, bearing interest varying from 7 per cent. to 12 per cent., to a total of £344,378. It is estimated that the annual saving of interest to the farmer through the reduced rate of interest on bonds previously held elsewhere is well over £7,000 per annum. This saving of interest is of very considerable benefit to the farmer, but the system of redemption under bonds to the Bank is perhaps of even greater importance. Prior to the establishment of the Bank, a debtor with an 8 per cent. bond of, say, £1,000 at the end of a 20-year period would have paid £1,600 in interest and still be faced with the unsatisfactory fact that the £1,000 debt was still owing. Under the present redemption system, when a similar sum of £1,600 has been paid, three further half-yearly instalments of £43 5s. will meet all accruing interest and redeem the entire loan. Another instance of benefit is seen from the following example:—A farmer who obtained a loan six years ago and who has since paid the 12 half-yearly instalments of a 20-year bond has reduced the capital debt by £188 5s. on each £1,000 borrowed. The debtor has thus established a credit on which to fall back in time of real stress, should the circumstances of the particular case permit.

It is a little over six years since the Bank was established, and during that period £193,745 has been paid to the Treasury, being 5 per cent. interest collected on the capital advanced, varying from £62,000 at the end of December, 1924, to £970,000 at date. The report states that a further

sum of £30,267 interest will be paid to the Treasury before 31st March in order to bring payments—in all £224,012—up to date at the conclusion of the financial year. The cost of working the Bank is .66 per cent. of the capital invested.

Agricultural Legislation.—A considerable number of measures concerning the agricultural industry is under consideration by the Legislative Assembly which is now in session. The list is as follows:—"Cattle Levy Act, 1931"; "Chilled and Frozen Meats Export Act, 1924, Further Amendment Act, 1931"; "Dairy Industry Control Act, 1931"; "Maize Control Act, 1931"; "Stock and Produce Theft Repression Ordinance, 1907, Amendment Act, 1931"; "Tobacco Sale and Export Control Amendment Act, 1931"; "Land Tax Amendment Act, 1931"; and "Game and Fish Preservation Amendment Act, 1931." Of these, the last three have, at the time of writing, been passed by the Legislature, and it may be useful to set out the main features of the amendments which have been introduced.

Tobacco Sale and Export Control Amendment Act, 1931.—The original Act which was passed in 1930 provided for the establishment of a board to regulate and control the sale and export of tobacco produced in Southern Rhodesia, and was introduced primarily to deal with the Union quota. The present measure incorporates certain amendments which experience of the first year's working of the Act has shown to be necessary. In section 5 of the original Act the board was given certain powers, none of which was to be exercised without the permission of the Minister. In the working of the Act it was found to be very inconvenient, in fact almost impossible, to wait until the Minister's approval had been obtained. The present Act transfers this power to the board and also amends the representation. In the original Act the producers appointed six members out of the seven and the Government one. The growers will now appoint five members and the Government two. Sub-section (d) of section 6 of the original Act, which prescribed as one of the duties of the board the allocation

of all duty-free tobacco to manufacturers, has been deleted. The Minister explained that in practice this provision was found to be a handicap to the board, and in one particular case occasioned a good deal of delay. Such delay is very often a serious matter to the board, because it delays the closing of the pool and the paying out of the proceeds of sale. Section 10 of the original Act, which read, "All contracts for the sale of tobacco by the board, and all allocations to manufacturers of duty-free tobacco, shall be subject to the approval of the Minister," has been amended to read as follows:—"Allocations, if any, to manufacturers of duty-free tobacco shall be subject to the approval of the Minister." The name of the board has been amended to "Southern Rhodesia Tobacco Board." An addition to section 14 of the original Act entitles the board by regulation to charge fees for registering cessions and providing duplicates of participation certificates.

Land Tax Amendment Act, 1931.—This measure amends the Land Tax Act of 1928, in which were found in practice certain anomalies and hardships. The chief amendments occur in section 5 of the principal Act, which lays down the conditions required to render land non-taxable. Under the provisions of the Act farms which were fly-infested and where trypanosomiasis existed were, at the discretion of the Minister, exempt from taxation. The scope of this section has been widened to cover any "disease destructive to stock." In sub-section (6) of section 5 of the Act it was provided that a certain number of stock grazing on the farm was one of the qualifying provisions of exemption. In the working of the Act it was found that there were farms which were leased and were fully stocked by the lessee, but there was no power to exempt the farms under the Act. The words "or *bona fide* lessee" have now been added to the section, thus extending the exemption powers in this respect. Certain sections of the amending Act provide for exemption for a limited time of certain farms instead of for all time. This applies in the case of a farm offered for settlement at a stipulated price. The wording of the original Act in regard to land planted with trees was not very clear. It is now amended to make it quite definite that there must be sufficient trees to exempt the whole of the farm. In other

words, there is no partial exemption; and the proportion is one morgen of growing forest trees to every fifty morgen of such land. Provision is also made for the exemption of land held in trust for minor children under the provisions of a will and land declared by the Minister untaxable by reason of the existence of mining claims thereon. A further amendment has to do with exemption due to development. Under section 8 of the original Act the Minister could exempt whole or part of the farm in case of occupation, but no provision was made in the case of a man who was developing his farm although not in actual occupation of it. The Act has now been amended so as to permit exemption of a farm which is being developed prior to occupation. A new section provides that where there are two or more areas of land, not more than five miles apart, registered under separate title deeds, owned or leased by one person and actively or continuously worked in conjunction with one another, they may be treated as one for the purpose of the Act. If the areas are more than five miles apart the approval of the Minister has to be obtained before such grouping is recognised. Finally, the operation of the Act may be suspended by the Governor by Proclamation until such time as it is considered desirable to bring it into force again.

The Game and Fish Preservation Amendment Act, 1931.—One effect of this Act is to prohibit trespass on native reserves. Under the original Act of 1929 it was an offence to trespass on private property in pursuit of fish or game against the will of the owner; the present Act extends the prohibition to trespassing in the same way on native reserves. There is, however, nothing to prevent a native lawfully residing in a native reserve from hunting or fishing therein if he is in possession of a licence. The most important provision of the present Act in so far as the farmer is concerned is an extension of the power vested in the Governor to make regulations prohibiting the setting of snares and traps. Under the original Act the Governor could prohibit the capture or destruction of game by means of nets, springs, game traps, snares and other contrivances, while he could also regulate the coursing of game by dogs. But the power so conferred only related to game. The Act has now been amended so as to include "other animals and

birds," which it is hoped will go far to eliminate a practice that has caused a great deal of trouble to farmers and stock owners.

African Coast Fever.—A case of this disease has been diagnosed on the farm Lorelei, which is situated about six miles east of Salisbury. The infected animal has been destroyed, and the herd of in-contact animals has been taken under the control of the veterinary authorities. All movement of cattle in the Salisbury district, except for slaughter, has been suspended as a precautionary measure. So far as is known, this farm has not been infected previously.

DATES OF AGRICULTURAL SHOWS.

Midlands Agricultural Society, Gwelo, 12th June.

Umtali Agricultural Society, Umtali, 24th and 25th July.

Bindura Agricultural Society, Bindura, 25th July.

Rusape Agricultural Society, Rusape, 7th August.

Rhodesia Agricultural Society, Salisbury, 26th and 27th August.

Bulawayo Agricultural Society, Bulawayo, 2nd and 3rd September.

The Rhodesia Railways have agreed to grant the same concession on the road motor service as that allowed when show exhibits are sent by rail, *i.e.*, full rates will be charged on the forward journey, and, if unsold, the exhibits will be returned to senders free of charge, provided the necessary certificate is obtained from the secretary of the show.

The Great Economic Problem in Agriculture.

No. 1.

By J. R. McLoughlin, M.Sc. (Economics),
Economic Adviser.

[*We are very pleased to publish the following article by the Economic Adviser. It is the first of a series of twelve which he will write for this Journal dealing with the economics of agriculture. In the present preliminary article the writer provides much food for thought and shows the necessity for approaching present problems with an open mind. To use his own words, "It is an attempt to induce broad thinking and an appeal to avoid sectionalism by presenting the main problem in agriculture as a social one." As such we commend what is written to the careful attention of readers.*—Ed.]

With this article the writer commences a series which will extend over a period of a year. The present article is considered a necessary preliminary to those which will follow.

It is an extremely difficult matter to discuss economics with the layman, the principal reason being that the layman is generally a bit of an economist himself. It is remarkable also how tenaciously "practical" men cling to their ideas and how persistently they dispose of many arguments by merely stating that they are "theoretical." A broader approach to any subject recognises the essential truth that theory and practice are supplementary to each other, and

that no matter how practical a certain line of action might be, it was at one time only a theory in the mind of the man who conceived it. To those who are open-minded enough to forbear with the thoughts of any man, let the economist exclaim, like Hamlet to his young friend, "There are more things 'twixt heaven and earth than were ever dreamt of in thy philosophy."

The study of economics is a very old one, and it is divided into many branches. Although most people do not generally realise it, some of the most important principles of government, finance and commerce are based on the teachings of economists. The latter day economics aims at going further than the general principles laid down in classical economics and tries to examine and measure the size and influence of various factors in a general situation. That means that studies are made in figures of the many things that have a bearing on the prosperity of industries and on the people dependent on them. Rather than pursue this aspect further, it will be left to the reader to gather from the discussions what the general use of economics is.

The writer will endeavour to cover in the series of articles to follow many of the important things affecting agriculture of which it is essential that the modern farmer should have a knowledge. After discussing things which are general, we can proceed to the specific. When we reach that point it is time for practical accomplishments in improving the lot of the farmer. It is very essential, however, before the work of an Economics Branch can accomplish its purpose, that opinion in farming circles be influenced and that the minds of farmers be opened and cleared on a good many points that cause confusion to-day.

The World Situation in Agricultural Industries.—For many years agricultural economics received no special attention from economists. The subject was treated as a part of general economics, where indeed it also belongs, but the specialised study of it during the past twenty years has caused most economists to realise that it forms a distinctly separate branch of economics. The old problem in economics, as it affected man's welfare after an article had been produced, was to decide what share of the product should go to each of the claimants, viz., land, labour and

capital. But it becomes clearer as time goes on that a broader and mightier struggle is being enacted with agriculture on the one side and most other industries on the other.

The conception in the foregoing statement is not a mere theory. The studies of price tendencies and purchasing power of agricultural products compared with those of mining and secondary products during the past three decades reveal what no one can fail to discern as a great gathering force which will affect the economic and political welfare of man. It is unmistakably shown in these studies that in all big movements in the price level agricultural products fall before and rise after industrial products. Moreover, these falls are on the average more abnormal than for secondary products. Added to this is the well-known fact that the retail prices fall much more slowly than wholesale and agricultural prices. Again, we find some of the remarkable phenomena of value playing tricks with agriculture; for instance, an increase of, say, 5 per cent. in the production of certain agricultural commodities will result in a 20 per cent. fall in price, whereas a decrease of 5 per cent. in production will yield no more than a 10 per cent. increase in the price, where the demand in both instances remains much the same. In secondary products not nearly the same disparity is shown. The result of some of these things is evident in the wide fluctuations of the purchasing power of agricultural products, and a more or less continuous disadvantage in agricultural purchasing power compared with that of non-agricultural industries.

It is not possible here to go into the many causes of these peculiarities except to say that they are due partly to protection of secondary industries and partly to the very nature of agriculture; partly to the weaker forms of organisation found in that industry and partly to the fact that machine power has raised the productive capacity of the man and the land. One must, however, consider here some of the more noticeable effects. There are signs all the world over of a growing disadvantage with which agriculture finds itself faced, and that is becoming a potent force in the economic policies of nations. There is somewhere in that tendency a law or set of economic laws which it is the duty of economists

to discover. One of the best indications showing the effect of this tendency is found in a certain section of North America, where the farmers produce wheat and sell it at the world price. Their land is amongst the best yielding of all wheat-producing countries, and yet while their equity, that is, the unbonded share of their capital value, was 85 per cent. in 1905, in 1925 it was only 18 per cent.; and land values had meanwhile nearly trebled. These people have reverted to the status of tenants because they have been forced to live on capital. They are, moreover, an unstable and radical element politically. Such is the fruit of an uncontrolled agricultural policy. The policy of protection of secondary industries in the U.S.A., without adjusting the power of agriculture to compete on equal terms, has had a great deal to do with it. Those wheat farmers could not continue to sell their product at the world price and buy their means of production and living at the high protected level.

These tendencies in agriculture have also become more marked throughout Central Europe, including even well-organised Germany. In spite of all sorts of palliatives, Governments are finding a very strong drift towards tenancy among the best types of peasant owners. None realise more forcibly than European statesmen the consequences to the world if the land-owning peasant becomes a radical political force with no stake in the land he ploughs.

There are numerous causes for the recurring difficulties in agriculture, such as competition from new areas, protection of secondary industries, wide fluctuations in seasonal prices and production and a score of others. Most of these conditions are merely temporary, and the various economic forces compel all fluctuations to go above and below a certain normal condition. Apart from these ordinary and natural problems, however, there is even in the most normal and adjusted condition in agricultural production the clear and unmistakable tendency for it to be at a greater and greater disadvantage compared with other industries. One can almost say that there is a growing tendency for other industries to gain what agriculture is losing. This brings us back to the point from which we started—the great problem of what forces control the share of the product which goes to the partners in producing wealth. The world is thus faced with a new problem of

distribution, and the two claimants are agriculture and other industries. It arises because of the superior organisation, finance and bargaining power of most non-agricultural industries. There is no question of blame—it is an evolution in the progress of mankind.

There are two ways of meeting this situation. The one is for farmers to accept a lower standard of living—which it is only human to oppose—and the other is to work for the better organisation of agriculture. This organisation, the writer might add, will extend far beyond our present conceptions of co-operation, control and even the relation of the State to the agricultural industry. Some indication of these will be given in later articles.

It will be very evident to readers, after having gone so far, that when one utters the word "policy" it is necessary to extend one's arguments far beyond the mere introduction of that most misunderstood "law of supply and demand" to prove and disprove arguments in regard to economic policy. The law is there, on the fringe of a great problem, but it is a mere step in the consideration of it. This law will be explained in a succeeding article, and it is hoped that its clarification will show just what bearing it has on the solution of the economic problems in agriculture.

It is a cruel and false conception to approach agricultural policy from the standpoint of £ s. d. only or with a purely sectional outlook. Once economics becomes divorced from the broader social outlook by viewing it in terms of money, first and last, it loses its potency as a force for good. The aim must be to try and strike a neat balance between the purely monetary and the social result of our line of action. It is very essential for all sections of the community to be educated to view the economic problems of agriculture dispassionately. Sectional hostility must not be encouraged. There are far too many attempts, all productive of fallacious notions, which aim at proving how much the townsman contributes to revenue and how much the farmer, and why any assistance to one section is an imposition on the other, and so on. It all reminds one so much of the argument as to which was the fish most due—the hook, the line or the rod. It is remarkable how many people are trying to solve this insoluble problem. There need be no argument as to who is the backbone of the

country. The people as a whole are. The ledger and the balance sheet are only one step in better economic organisation, and it is essential to break the bonds of these narrow confines in the minds of all sections of the community before we can evolve a sound and helpful agricultural policy.

This introduction, though general, serves to illustrate the point of view from which we must face the problems of agriculture in the first instance. It is an attempt to induce broad thinking and an appeal to avoid sectionalism by presenting the main problem in agriculture as a social one. The first and foremost duty of an Economics Branch in a State Department is to provide information in regard to, and analyse, all economic tendencies of a fundamental and world-wide character. Not until this is achieved can we proceed to a consideration of more specific things and to those activities of the economist which should give practical and tangible results.

The next eleven articles will be as follows: (2) The Law of Supply and Demand: its real meaning in practice; (3) Prices: their meaning and how to interpret them; (4) Stabilisation in Agricultural Returns; (5) Stabilisation, etc., continued; (6) Cost of Production; (7) Land Values; (8) Agricultural Credit and Finance; (9) Money and the Effect of Inflation and Deflation on Agriculture; (10) Co-operation as a Movement and a Force in Agriculture; (11) The Evolutionary Stages in Production and the Transition from one Form of Agriculture to another; (12) World Tendencies in the Production of some Agricultural Commodities and their Relation to Rhodesia.

Thus ends the first, if unorthodox, instalment in the series of articles to follow.

Foot-and-Mouth Disease.

The following report has been submitted by the Chief Veterinary Surgeon to the Government:—

HISTORY OF OUTBREAK.

It is impossible to fix any given date for the first cases of foot-and-mouth disease on the Nuanetsi Ranch or in the district. I gather from the manager that "three-day sickness" had been very prevalent on the ranch, as in practically every district in the Colony, but reports from various sections increased to such an extent that he investigated personally.

As far as can be judged the disease appeared first on the Nuanetsi Ranch amongst cattle in the vicinity of the Nuanetsi bridge on the main Fort Victoria-Beitbridge road, but the disease came with such a rush that in my opinion it is impossible to fix definitely the approximate date of the first infection or the area or section in which it first appeared. Indeed with the information at my disposal I think it possible that the infection first occurred on the Crown land east of the Diti stock reserve in the Gwanda district. I will refer to this point later.

I left Nuanetsi Ranch on the 7th April to meet the District Veterinary Surgeon, Bulawayo, by appointment and also hoping to meet the Union veterinary officials, but received a message from Pretoria that they would not arrive until Thursday, the 9th idem. Accompanied by Mr. Hooper Sharpe I then proceeded to Liebig's, and the following day inspected several infected herds on Section 8, which is situated on the Nuanetsi River, in the vicinity of the bridge on the main road.

I arrived at Liebig's Drift on Thursday, 9th, and found a Mr. Mann waiting for me to report sickness amongst his cattle at a small camp on the bank of the Limpopo, four miles east of Beitbridge. Mr. Mann had brought 30 head of cattle from Shashashas, 58 miles east of Beitbridge and about 15 miles north of the Limpopo River, and amongst these I

found unmistakable signs of foot-and-mouth disease, which, judging by the lesions in mouth and feet, had existed for some time. The feet in some animals were badly affected; I noticed one ox in which complete separation of all four claws from the coronary band had taken place in both hind feet. I am of opinion that these animals contracted the disease on the road from Shashashas, hence my suggestion of the possibility of an earlier infection than that on Nuanetsi Ranch. Further investigation into the position in this area will be made at an early date. It may be remarked that none of the other animals at Mr. Mann's camp were then showing signs of the disease. I instructed the cattle inspector to examine these cattle daily in order to detect the first symptoms of the disease.

Later in the day the following arrived at Beitbridge, viz., Dr. du Toit, Director of Veterinary Services in the Union; Mr. May, Senior Veterinary Officer, Transvaal; Mr. Bergh, District Veterinary Officer, Louis Trichardt, and Mr. Borthwick, formerly Principal Veterinary Officer in the Union. I took them to Mann's camp, where they were very quickly satisfied that foot-and-mouth disease existed. The following morning we proceeded to Nuanetsi Ranch headquarters, thence to Section 8, Liebig's, and back again to Nuanetsi. The visitors left at midday on the return journey to the Union.

Some time prior to the diagnosis of the disease on the Nuanetsi Ranch nine spans of oxen left there for Fort Victoria for grain. The wagons were loaded in Victoria and got as far as the Tokwani River, about 40 miles from Fort Victoria, when it was found that all the animals were so lame that they could not proceed. I questioned the driver in charge of the convoy, an intelligent Cape boy named Paul. He informed me that none of his oxen showed any signs of sickness until one day from Victoria, when they all went lame. He stated that they were never off their feed and that the only signs he saw of sickness, apart from the feet, was that one animal was unable to drink. There is no doubt that these oxen were infected before leaving the ranch and disseminated the infection en route and on Victoria commonage..

On Victoria commonage the disease was discovered on 9th instant.

On 13th instant cattle were reported sick on the farm Seed, 10 miles out of Enkeldoorn, on the Salisbury road. I visited the farm on the following day and found a large number of animals infected. Indeed it would be correct, I think, to say that all were infected, some 1,400 to 1,500 head. The infection in this case was carried by 30 head which left Victoria commonage on 29th March and arrived at Seed farm on the 3rd April. The manager of the farm was advised to keep the cattle under observation. On 9th instant he reported that these cattle were lame, which he attributed to driving from Victoria. He did not observe any symptoms of mouth trouble in any of them. On 12th he noticed a number of farm cattle sick and reported at once to the cattle inspector. There is no doubt that these cattle were sick when they left Fort Victoria and passed through the acute stage on the journey, and of course the route traversed must be infected.

VIRULENCE OF THE DISEASE.

The disease is of a very mild type. So far I have not been able to make any observations on the onset and course, but it is remarkable how exactly alike are the statements of those who have handled infected herds to date. The first symptom noticed was stiffness and lameness, the apparent stiffness being due no doubt to all the feet being affected, hence its being mistaken for three-day sickness to begin with. Now that the men concerned are better acquainted with the disease they can observe the earlier stage, and it was stated by several that lameness occurs after four days' illness. District Veterinary Surgeon Myhill endeavoured to find an animal in the early stages in order to obtain material for biological tests, but was unable to do so in the time at his disposal.

The general course of the disease, with the information at my disposal to date, may be summarised as follows:—

(1) The onset of the disease is very mild and may pass unnoticed.

(2) The lesions in the mouth, whilst distinct and characteristic, do not generally interfere with feeding or drinking.

(3) The foot lesions appear after the acute stage has passed and are not as a rule severe. Where animals are driven, however, during the acute stage the feet become severely affected, leading in some cases to complete separation of the hoof from the coronet. In these no doubt the hoof will be shed ultimately.

(4) In most cases recovery is rapid. There is some loss in condition, depending, of course, on the severity of the disease, especially when the feet are badly affected.

(5) So far no lesions have been observed on the udder or other parts of the body.

MORTALITY.

As the type of disease is mild a heavy mortality is not to be expected. So far as I have been able to ascertain the death rate appears to be under one per cent., except in calves up to three weeks old, in which up to 50 per cent. succumb.

The greatest losses will, I think, occur later in the year. Even in mild cases the animals lost some condition, which there is little chance of regaining under present conditions, and it looks as if we were in for a long winter; the mortality from poverty is likely to be very heavy before the next rainy season.

The loss of condition is very rapid in animals which have been driven during the early stages of the disease. In such cases complete separation takes place between the hoof and the coronet and suppuration sets in, which may result in shedding of the hoof.

ORIGIN OF INFECTION.

There is no clue whatever as to the source of infection.

Foot-and-mouth disease is enzootic in parts of East Africa, e.g., Uganda, Kenya and Tanganyika, but I am confident it has not come from there by direct means, i.e., by cattle or game, otherwise its first manifestations in this Colony would have been nearer our borders. Besides we would have intimation of its presence in Northern Rhodesia, Nyasaland and Portuguese territory.

Infection must, of course, have been introduced from somewhere, and by some indirect means. It is generally accepted that the virus remains active for long periods on various articles, and particularly on hay and bran, but no such articles have been imported by the Nuanetsi and Liebig's Ranches. There is a store on the headquarters section of Nuanetsi and hay and straw from Europe may have been imported as packing either direct or indirectly through a Union port. Enquiries will be made on this point when I next visit Nuanetsi. Against this there is the fact that hay and straw as packing have been coming to South Africa for forty years without introducing infection. Further, in Great Britain it is not possible to control hay and straw introduced as packing from the Continent, where foot-and-mouth disease is endemic, and as far as I can say at the moment no outbreak of foot-and-mouth disease in England for many years has been attributed to such a source.

Birds have been suspected of carrying infection from the Continent to Great Britain. There are various migratory birds which come here from the north, e.g., quail and storks. It is difficult to imagine, though, how a bird could carry an infected piece of hay or grass even from an infected area in Kenya.

No animals have been imported from overseas by the Nuanetsi and Liebig's Ranches for two and three years respectively, so that this source of infection can be eliminated.

I cannot suggest how any infected material could be carried by aeroplanes.

EXTENT OF INFECTION.

At present the main road from Beitbridge to the farm Seed, 10 miles this side of Enkeldoorn, is infected.

To the west the limit of infection is Section 8 of Liebig's Ranch, which adjoins Nuanetsi Ranch at the Nuanetsi River.

To the east the furthest known infection is Shashashas, 58 miles east of Beitbridge.

When I was last at Nuanetsi Ranch five sections were infected.

It is impossible to say how many cattle have actually been infected. Probably forty or fifty thousand to date. When a herd becomes infected, practically every beast contracts the disease.

(End.)

SYMPTOMS OF DISEASE.

In the early stages of the disease the animal is lame and frequently smacks its lips, and shows by the movement of its tongue that the mouth is the seat of suffering, and the saliva flows freely from the mouth. An examination of the mouth shows the existence of vesicles on the tongue and on the inner part of the upper lip and on the pad. These vesicles show themselves in the form of a tough white skin which can be easily stripped off, and a red, raw surface is found beneath.

The animal seldom refuses food, but rolls it about in its mouth, and often drops it instead of swallowing it. In most instances the feet are affected as well as the mouth, and blisters will form between the toes and on the heels between hair and hoof, causing the animal to walk tenderly, and frequently to catch up one foot after the other and shake it as if to dislodge something which was producing pain.

In milch cows the teats may be affected with vesicles, especially at the opening of the milk duct. This often leads to sores and crusts being formed, which prevent the ready flow of the milk. The disease frequently exists simultaneously among the cattle, sheep and pigs of the farm.

All persons owning or having in their charge any animal or animals presenting any of the above symptoms are required by law to give notice to the cattle inspector or Veterinary Department with all practicable speed.

GENERAL.

Per Government Notice No. 251 of 17th April, 1931:—

1. The movement of all cattle is prohibited within and from the following native districts, viz., Bikita, Gutu, Chilimanzi, Victoria, Ndanga, Chibi, Selukwe, Belingwe, Charter, Gwelo and Gwanda; provided, however, that special permits may be authorised by the District Veterinary Surgeon for

the removal of cattle for meat supplies, local transport or other essential purposes.

2. The removal of all horses, mules, donkeys, sheep, goats and pigs from the districts specified under section 1 is prohibited, except under special permit by the District Veterinary Surgeon.

3. The removal of hides and skins within and from the districts specified under section 1 is also prohibited, except under special permit by the District Veterinary Surgeon and under such conditions as may be deemed necessary to impose.

Dipping operations have been suspended in the following districts to avoid the dissemination of infection by contact at dipping tanks: Victoria,, Ndanga, Chilimanzi, Bikita, Chibi, Gutu and Selukwe.

The introduction into the Union of South Africa from Southern Rhodesia and Bechuanaland Protectorate of all animal products, including hides, skins, horns, hoofs, wool, hair, feathers, milk, cream, blood, meat and manure, is prohibited. The introduction into the Union from Southern Rhodesia and Bechuanaland Protectorate of all vegetable products, including grass, grass-hay, straw, lucerne hay, mealies, mealie stalks, cobs and kaffir corn and stalks, is prohibited, except by special permission of the Minister of Agriculture and Lands.

A similar restriction applies to the importation of the same articles into Bechuanaland from Southern Rhodesia.

The Union Government has established a disinfecting station on the north bank of the Limpopo River at Beitbridge, through which all horse, mule and motor traffic will have to pass before being allowed to proceed into the Union. This step has been considered advisable, as infection can be carried as easily by the mud on the wheels of motor cars as by the hoofs of animals.

In so far as Northern Rhodesia is concerned, all movements of live stock from this Colony are prohibited, as are frozen meat, hides, skins, fodder, hay and straw packing.

Export of ruminant animals, hay and straw to the United Kingdom is stopped, but the British authorities have allowed the cattle on the Clan Morrison to be landed at Cardiff.

Extracts from the Report on the Work of the Cotton Breeding Station, Gatooma,

FOR THE SEASON 1929-30.

By J. E. Peat.

[*We regret that it is impossible to reproduce the whole of this report, which is a very comprehensive document of* 54 *pages of letterpress, with numerous graphs and several illustrations. It is contained in a volume of similar reports issued by the Empire Cotton Growing Corporation, whose offices are at Millbank House, Millbank, London. The price of the volume is* 2s. 6d., *post free. Sufficient is published here, however, to show the important work in progress at the Gatooma Cotton Breeding Station and the valuable results so far achieved. There remain many problems still to be solved, but as Major Cameron states in an introductory note to the report, we can look forward with confidence to the time when cotton will take a much more prominent position in the farming operations of this Colony.*—Ed.]

The season has been an interesting and very important one, dominated by the attack of American bollworm. Important progress has been made.

Throughout the country there have been bollworm attacks varying in intensity, light in some localities, heavier in others, but probably in few places more heavy than on the

station. Some very good crops have been obtained, some failures, and a big proportion of moderate returns.

The experimental and breeding results, therefore, must be examined in the light of this attack, and probably appropriately so for the rest of the country. At the moment it looks as if the possibility of serious bollworm attack were the remaining big obstacle to fully successful cotton growing in Southern Rhodesia. A proposed extension of records and detailed observations into the districts is discussed in the report.

Climatically the season was moderately favourable to cotton on the station, though, as shown, the drought periods may have been unfavourable to the production of strong cotton. Good rains enabled planting to commence in the middle of November, and good stands were obtained. The two drought periods also had the effect of pushing the main flowering into March, where it was caught by the American bollworm attack, thus accentuating the serious effect of the latter. Low temperatures in the latter half of June and in July prevented the setting on the station of a potential second compensatory crop by the better strains, after the dying away of the bollworm infestation.

Jassid attack was similar to that of other seasons. The susceptible strains collapsed, and in their powers of resistance, strains previously recorded as resistant were satisfactory. Stainers were numerous, but again it is considered that a fair measure of control was effected by the system of trapping practised.

The bollworm infestation, mainly American, developed on the station early in March. It was heavy. Several of the Gatooma U.4 selections, especially /64, and re-selections from /64 and /26—64/7 and 26/4—which are prolific and hold on to a good early crop, showed up markedly well contrasted with neighbouring U.4 selections, and with the U.4 mixed bulk, the commercial U.4 of the country. Observation blocks of jassid-resistant strains other than U.4 failed completely under the bollworm attack.

Strain /64 appears a satisfactory family, and seed from its multiplication is being issued to growers this year. The

breeding and issue of these strains may help considerably in the setting of a payable crop in spite of bollworm.

The majority of growers obtained successful results in the multiplications of the U.4 special bulk, issued in 10-lb. packets last season. This is discussed below. Several secured a yield exceeding 1,000 lbs. of seed cotton per acre, at a very thin seed rate and wide spacing.

The results on the station, supplemented by replicated trials undertaken by a few farmers in other districts, show for the season the marked benefits of a closer spacing than that which is being adopted. Even with a very bad bollworm attack, had prices been better, the yields at the closer spacings would have presented almost a paying crop contrasted with the poor returns at the wider spacings; trials from a good crop, practically unattacked, at the 1,000 lbs. per acre level, are also markedly in favour of the closer spacing. The possible dangers of a closer spacing are discussed.

Other possible methods of bollworm control are outlined; these include experiments in mechanical dusting with calcium arsenate, and the breeding up and liberation of egg parasites —possibly complementary measures—also the dusting for a heavy brood attack not checked by the egg parasites.

Results from fertiliser trials do not give satisfactory evidence of improvement in yield, quality, or earliness from fertiliser applications in the normal way. Further experiments are required, including work in other districts.

Good lint quality is showing up in the better-yielding re-selections, including good length, fair strength, uniformity and satisfactory ginning percentages. In a difficult year for strength, several of the better lots compare very favourably with the bulk and neighbouring strains in this quality. Progress is being made in the analysis of the range in these qualities. Length irregularity is discussed.

Season.—Climatically the season might be described, for the station, as moderately favourable to cotton on old land.

The rainfall recorded was 29.23 inches. The planting season was relatively early and good. A good rain on 14th November enabled final harrowing to be done and planting

to be started. This was followed by good rains on the 22nd, 23rd and 26th. Good stands were obtained and the young plants got well away. A dry spell during the latter part of December and early January lasted longer than was good for the cotton, though the crop did not show much sign of distress. Growth was slowed down in January. This must have had the effect of slowing down the flowering curve in February, pushing the heavy flowering period, the peak period, late. Thus a large proportion of the heavy flowering which might have been expected in February was pushed into March and was caught by the heavy bollworm attack. This drought period, together with the drought period in February, thus had the effect of accentuating, by reason of the low yields they caused, the seriousness of the heavy bollworm attack.

This delay in the peak period of heavy flowering meant a delay in the main period of boll opening, throwing the main period of boll development into a period of lower temperatures, a result which was especially marked this season. For an early season the main pickings were distinctly late throughout the country. This late development of the crop in a period of lower temperatures may account for much of the softness in the lint.

A further drought period started at the end of January and continued for the first three weeks of February. Maize suffered badly. Cotton appeared to stand the drought relatively well, but growth first slowed down and then practically stopped; the smaller plants showed signs of being stunted. These two drought periods, coming in a year of early and heavy bollworm attack and a year of low dry weather temperatures, must have reduced the potential crop very considerably by throwing it late; to a certain extent they may also explain the softness of much of the lint.

These records bear out the necessity in Rhodesia of planting as early as the rains permit; cotton should probably be given priority in planting to maize and most of the other crops grown.

The drought was broken by a fall of over 5 inches on 20th February. This caused a heavy shedding of buds, squares, and young bolls, causing a further loss of the potential earlier crop. Were it not for this peak of shedding,

the percentage of the loss attributable to bollworm would show up more markedly than it does.

March was relatively a dry month. Low temperatures and cold winds in the latter half of June and in July prevented the setting of a compensatory second crop after the bollworm attack died down. The better strains showed a fair potential crop, which, however, did not develop.

On the station frost was not experienced. The lowest minimum temperature recorded was 34.5° on 29th July. Neighbouring farms had frost during the night.

Insect Attack.—*Bollworm.*—The season on the station was completely dominated by a more or less continuous attack of American bollworm, starting from the beginning of March, rising to peaks caused by the two main broods in the middle of March and the middle of April, and continuing into May. The attack was irregular in its incidence, but, speaking generally, it cleared off most of the middle and all of the top crop, from the better and earlier, and practically everything from the poorer and later, strains. Most of the growers in the country suffered in varying degrees, few, however, probably more heavily than the station, so that the reactions of the strains and mixed bulk under the various treatments on the station may be taken as reactions to a bollworm attack which was probably as heavy as any in the country this past season. A number of growers suffered little or no damage, and with many others the attack developed later than on the station, quite moderately good crops resulting.

The serious damage was done by American bollworm in three or more main broods. From the beginning of February to the end of May in the daily collection of bollworms for record taking, 72 per cent. were American (*Chloridea obsoleta*), 9 per cent. Sudan (*Diparopsis castanea*) and 19 per cent. Spiny (*Earias* spp.). For March the percentages were 83 per cent. American, 2 per cent. Sudan, and 15 per cent. Spiny; and for April, 75 per cent., 12½ per cent. and 12½ per cent. respectively.

American bollworm is a particularly serious pest. With an early attack, a given number probably do a much greater amount of damage in their lifetime than an equivalent number of Sudan bollworms. They specially attack buds, flowers,

and the younger bolls, destroying in a relatively short period a big proportion of a potential crop. They move about a great deal in feeding; even the young larvæ are very active, dropping from fine threads if touched. They appear to have a special liking for the flowers. At the height of the attack a large proportion of the open flowers had American boll-worms inside, eating the stamens, the pistils and the corolla. They attack the older formed bolls to a very much less extent, and when they do, they seldom eat them out. For this reason, in a sudden attack, if it is not excessively severe, a big proportion of the bolls already well formed escape damage, or are only slightly damaged. If the type of attack experienced in the country during the past two seasons is characteristic of that which may usually be expected, this points to the necessity of forcing on an early crop by breeding and by cultural methods.

Sudan bollworms are different; these, especially the older larvæ, are found mainly in the older well-formed bolls, which they tend to eat out. Thus in countering a Sudan bollworm attack, the earliness of a crop is not so important as a consideration of the prolific nature of the strains, probably a larger number of smaller bolls in preference to a smaller number of bigger.

On the station, Sudan bollworm has been a minor pest this season—a steady small nibble through April and May—the larvæ being very small from an egg-laying at the end of March, and practically entirely full grown at the end of April. Coinciding with a heavy attack of American, the Sudan bollworm must have been checked considerably by the predaceous habits of the American. This is the first season that Sudan bollworm has been a pest of annual cotton on the station, and with the knowledge of its behaviour in other countries it is recognised that it may become more serious in subsequent years. Consideration is being given to this in the planning of general bollworm control measures.

(To be concluded.)

Extracts from the Report of the Director of Veterinary Research

FOR THE YEAR 1930.

Service.—The following are some of the many services rendered by the Department to the public free of charge:—The microscopical examination of blood smears and other preparations for pathogenic micro-organisms, serological tests for various diseases, *post-mortem* examination and the examination of tissues, tumours and other specimens, the examination of fæces for worms, biological tests for disease and the identification of insects, larvæ and parasites. Advice is given verbally and in writing, lectures are delivered and articles are contributed to scientific and popular publications. Vaccines are prepared for experimental purposes and issued free of charge, and others are issued at a nominal price little above the cost of production.

Quarter-evil Vaccine.—About seventy thousand doses of this vaccine have been issued at threepence a dose. This vaccine, which differs from other vaccines prepared elsewhere for the prevention of quarter-evil of cattle and sheep and is known as the "Rhodesian quarter-evil vaccine," has proved very efficacious and is deservedly popular amongst stockmen. It is also used in smaller doses for sheep, and quite frequently outbreaks of mysterious disease cease after its application. During the year attention has again been drawn to the death of old cattle on farms where the disease has not previously occurred. In one instance a cow fifteen years of age died from undoubted quarter-evil, the diagnosis being confirmed by microscopic examination. The usual practice obtaining is to inoculate only the young stock, but where the disease occurs in a herd for the first time it is wise to inoculate animals of all ages. The vaccine is so inexpensive that a single animal saved will pay for the inoculation of a considerable number.

Redwater and Gall-sickness Vaccine.—There has been little demand for this virus-vaccine, the use of which does not appear to be understood by stockmen. If it were not that the successful grading up of local cattle must largely depend upon it, the heavy expense in maintaining this vaccine would not be justified. The subject will be dealt with more fully later in this report.

Horse-sickness Virus-vaccine.—Less than one hundred doses of this virus-vaccine have been issued during the present year, horses and mules having been superseded by mechanical transport. A new method of inoculation based upon the formalin method, as used for the preparation of the canine-distemper vaccine, has been introduced by Whitworth in Kenya Colony, and is being further investigated by Du Toit and Alexander, of the Veterinary Research Department, Onderstepoort. If this should prove successful the need for the local method will cease, and those preparing it will be relieved of a grave responsibility. Our hopes have frequently been raised in the past by promises of a new and more efficient method of inoculating horses, but it has always been found best to rely upon our local method, and it may be well to continue to prepare our own virus-vaccine until a better is available.

It is understood that a scheme has been submitted to farmers' associations whereby they are encouraged to breed horses; and an application for 1,430 doses with which to inoculate all the horses on a large breeding station in the Union has been received, which indicates that the local method may still serve a useful purpose.

Infectious Abortion Vaccine.—Fifteen thousand doses of this vaccine have been issued, and those using it have reported favourably upon the results obtained. Some actually give it credit for possessing curative properties which, of course, are not claimed for it. This vaccine, which is free from the dangers admitted to be associated with the use of the so-called "live vaccine," gives rise to a plentiful formation of agglutinins, which, although not identical with immunity, are an indication of it. In view of the prevalence of this disease the demand for the vaccine is very small. This is largely due to the fact that stock owners attach little importance to the disease, which they believe "wears itself

out," as it may occasionally do—but not in the manner they anticipate. In some outbreaks infected animals have been detected and separated from uninfected by means of the simplified method of applying the agglutination test devised by this Department, and by periodical application of the test the latter have been kept "clean." This is particularly useful in pure-bred and dairy herds.

Trypanosomiasis Injection.—Approximately thirteen hundred doses of the special solution of potassium antimony tartrate, introduced by the writer in 1909 for the treatment of cattle suffering from trypanosomiasis, have been issued free of charge on requisition from the Chief Entomologist. On enquiry it has been ascertained that this remedy is frequently misapplied. In April last D.V.S. Huston and the writer visited infected farms in the Gatooma area, and together devised a scheme whereby treatment could be properly applied at what may be called a "remount" camp by an officer of the Veterinary Department.

Autogenous Vaccines.—Vaccines have been prepared in a special manner from material taken from sick animals, and have proved successful in the treatment of cases of mastitis in cows and especially useful in those cases of lymphangitis and orchitis of bulls which appear to be caused by the bite of the striped-legged tick (*Hyalloma ægyptium*). At the request of members of the medical profession similar vaccines have been prepared for the treatment of those tropical phagedenic ulcers of natives which often prove very refractory to treatment. The results in the majority of cases appear to have been eminently satisfactory. A full report on this subject will be published later.

Anti-myiasis Vaccine.—A vaccine has been prepared for the prevention and treatment of the so-called "screw worm infection" of cattle. This has been issued on an experimental basis to stock owners, on the understanding that they report upon the results observed. Only twenty-two reports, however, have been received, of which eighteen are very satisfactory, while four are not so favourable. In certain districts where the infection is particularly prevalent, inoculation has been used to protect animals against infection following castration, de-horning and branding. If on further

test the method continues to yield as good results as in the past, it should prove of great practical value.

Anti-ophthalmia Vaccine.—A vaccine was also prepared from the common micro-organisms met with in cases of ophthalmia. This is a serious and very prevalent disease of cattle in this country, and particularly virulent in better-bred animals, in which it causes serious injury to the eye and not infrequently permanent loss to the sight, to say nothing of the loss of condition in the affected animal. This vaccine was also issued for experiment and observation, but few reports were received. These were very conflicting. Some recorded good results; others stated that no beneficial effects were noticeable. This can be understood when the varied microbial flora of the eye and the difficulty of isolating the particular organisms responsible for the disease are remembered. Some of the reports, however, and our own observations encourage further efforts in this direction.

Finance.—The total allocation for Veterinary Research during the past year was £7,181, but of this about £1,250 was spent upon bulls for inoculation and distribution to farmers. A little more than £1,000 has been earned by the sale of vaccines, and a further £1,000 for the disposal of twelve imported bulls by public auction. Six imported bulls to the approximate value of £550, a span of oxen inoculated against trypanosomiasis valued at £100, and a number of experimental animals estimated at about £150 are still on hand and will be disposed of later. The actual cost of this Department is, therefore, about £4,000 for the year, a sum which, estimating the cattle in the country as two millions, represents approximately one halfpenny a head.

The Station.—The ninety-nine acres which comprise the Veterinary Research Station have been again sub-divided, and there are now twenty-four camps. A number of paddocks with shelters have been erected for sheep. Much of the timber grown upon the station has been used for fencing, and unoccupied camps have provided crops for feeding purposes. But the station is too small, and a farm to be run in conjunction with it is becoming increasingly necessary.

RESEARCH.

The present depression in agriculture has attracted attention to the possibilities of the pastoral industry, the prospects of which appear to be brighter than they have been for some time past. But it has to be admitted that the industry in this country is in a very backward condition and not at present in a position to avail itself of improvements in the world's markets should they occur. The total number of cattle in the country after forty years' European occupation is estimated as a little over two million head—that is, about one head to forty acres.

This unfortunate state of affairs is chiefly due to diseases, some of which have swept through the country decimating our herds, while others have insidiously exacted their toll. It is also an unfortunate fact that of the two million head the majority are too small and too slow to mature to find a permanent place in the overseas markets, where a regular supply of early maturing animals of uniform type only are required. Great improvement is necessary in our local stock before it can hope to compete with animals from other countries.

The sheep industry also is in an equally unfortunate condition, our flocks being so mismanaged and diseased that during the past year it was necessary to import thirty thousand sheep from the south to supply the requirements of local consumption. Pigs, poultry, horses and dogs are also the victims of known and unknown diseases.

It will thus be seen that in the past the progress of the pastoral industry has been impeded by diseases, and it is probable that its future development will be similarly handicapped unless an exact scientific knowledge is obtained concerning the diseases to which our stock are or may be subjected. This can only be acquired by practical observation and scientific research.

Trypanosomiasis.—It is estimated that more than eleven million acres, or approximately one-tenth of Southern Rhodesia, including some of the richest agricultural and most highly mineralised areas, are rendered unsuitable for settlement and development by the presence or menace of the tsetse fly (*G. morsitans*). For some years past attempts have been made by the entomologists to overcome this pest, as,

for example, the wholesale destruction of game, organised grass fires, clearance of forest and the destruction of the essential haunts of the fly, but none of these measures has proved entirely successful. Some alternative method of dealing with the problem appeared desirable. The Veterinary Research Department, therefore, being officially responsible for research into animal diseases, of which trypanosomiasis is undoubtedly one of the most important, decided to deal with the matter independently and from an entirely different angle, namely, by endeavouring to find a method of protecting domestic stock from infection. It was believed that if this could be done settlers might be encouraged to enter and develop infected areas, and that as the result of their activities the tsetse fly, which, according to Jack, "is very delicately poised in the balance of nature," might be disturbed and eventually evicted.

There was, to begin with, some evidence to encourage the hope that this might be done. Indeed, on a small scale it had already been accomplished. It was known that game, and in some countries cattle, became "tolerant" to trypanosome infection—that is to say, could harbour the parasite although unharmed by it. The same thing had been observed in connection with infected cattle, many of which, having recovered as the result of antimony treatment, thereafter appeared to resist re-infection. It was decided to investigate these facts with a view to finding a method whereby such "tolerance" might be set up systematically.

Since 1909 the action of antimony upon the course of the various local forms of trypanosomiasis of animals has been carefully studied, and experience has taught that the best results are obtained when the animal is treated in the early stages of infection and when trypanosomes are numerous in the peripheral blood. It has also been found that it is unnecessary, and indeed actually harmful, to exhibit the drug too frequently and at too short intervals. To obtain the best results a system of "timing" the treatment has been found desirable. But this is difficult to carry out under field conditions where the date of infection and the virulence of the strain of parasite with which the animal is infected are unknown. Many animals, therefore, treated in the haphazard manner which obtains in the field fail to

recover, or, having recovered, derive no resistance to re-infection. A system was therefore evolved which was first described by the present writer in the Transactions of the Royal Society of Tropical Medicine and Hygiene, Vol. XXII., No. 2, August, 1928, whereby animals are deliberately infected with a trypanosome of known strain and virulence, having a regular period of development and responding in a definite manner to treatment; the idea being to establish that "immunity tolerance" which frequently follows the haphazard field treatment.

The experimental work in connection with this method has been disappointingly slow and many unforeseen difficulties have been encountered. For example, one span of treated oxen when exposed to natural infection became heavily infected with "wire worm" (*H. contortus*), which was not at first recognised. It was only when the sick animals failed to respond to antimony treatment and some died, that the cause of the failure was determined. Another span inoculated with a strain of *T. congolense* taken from Gatooma, developed anaplasmosis which complicated the trypanosomiasis reactions. A third span, still under treatment, has suffered from the shortage of grazing on the station and commonage. With the onset of the rains there is an abundance of succulent grasses and the animals are rapidly improving in condition notwithstanding the infection. The survival of the inoculated animals, in spite of these adverse conditions, inspires confidence in the method. A full report will be furnished of the experiments which have been carried out in this connection when the final test, namely, the resistance of inoculated animals to natural infection, is completed.

As the result of practical experience a modification of the original method described in 1928 has been devised, which it is hoped may render the treatment of cattle in fly areas a less haphazard and arduous process than it is at present. Field experiments, however, cannot be carried out with privately owned cattle, and animals for the purpose will have to be provided.

While attention has been chiefly devoted to the above work, experiments in other directions having a practical bearing on the general problem of trypanosomiasis have been carried out. For example, the investigations commenced in

1927 in connection with the influence of dipping upon the course of the disease have been repeated. In the original experiments difficulty was experienced in determining the effects of dipping in animals infected with *T. congolense*, parasites not being sufficiently numerous or constantly present in the blood of either cattle or small laboratory animals. It was therefore decided to repeat the experiments, using a strain of *T. equiperdum* in guinea-pigs. The results again indicated that the absorption of arsenic and antimony as the result of short-interval dipping will suppress the development of the parasite in guinea-pigs, and if continued long enough will completely eliminate it. Similar experiments with cattle, using *T. congolense*, failed, the animals becoming "scalded."

Within recent years a drug called antimosan has been introduced for the treatment of *congolense* infection in cattle. This is superior to antimony potassium tartrate hitherto used, in that it can be introduced under the skin instead of into the vein, and is less harmful to the animal. It has one important disadvantage, namely, that it is too expensive for general use. A number of other preparations of antimony were tested with a view to finding one free from these disadvantages, but with little success. Many experiments were also carried out with laboratory animals with a view to ascertaining the best method of bringing about "premunition" or "immunity tolerance" by treatment, and the effects of inoculation with various strains upon such "premunised" animals. In spite of the desultory nature of the experimental work undertaken, some progress has been made.

Experiments were carried out by Mr. Lawrence with a view to preparing an antigen for the complement fixation test for the diagnosis of *congolense* infection in stock, but he reports that results were not encouraging, and the matter requires further work before a final report can be submitted.

Redwater and Gall-sickness.—During the past year experiments have been carried out with a view to improving the method of inoculation against redwater and gall-sickness of cattle. The existing method was evolved by the writer during the years 1905-09, and was first used on a large scale in 1911. Since then it has been applied with varying success

to several hundred cattle imported for the improvement of local stock, and to well-bred animals bred upon tick-free farms. Many of the best herds in this country have been built up from a foundation of such inoculated animals. Although the method has served its purpose, it has certain disadvantages. It can only be applied with safety to suitable animals under suitable conditions. In other circumstances it is not free from danger and mortality occurs. The inoculation reactions, more or less severe, extend over a period of some sixty days, and animals under treatment require careful supervision. A more simple and safe method which the stock owner himself can apply as easily as he does the quarter-evil vaccine, which, once injected under the skin, gives rise to immunity without any disturbance, is greatly to be desired. Unfortunately redwater and gall-sickness are not caused by bacteria which can be cultivated *in vitro* and can be converted into vaccines, but by minute animal parasites or protozoa which can only be grown in the animal body. Immunity against diseases caused by such organisms can only be acquired as the result of recovery from infection. The so-called virus-vaccine of redwater and gall-sickness, therefore, is the blood of an animal which has recovered from infection, but continues to harbour the parasites of these diseases. Such blood when introduced into a susceptible animal will give rise to these infections in a mild form, the lowered virulence of such parasites having been established by transference through certain types of animal. But the degree of virulence is easily disturbed; a single passage through an animal of low resistance will restore to them their original power of causing the disease in a deadly form. Before a virus-vaccine can be applied to valuable animals, therefore, tests have to be carried out to determine whether the parasites are still present in the "carrier's" blood, and if so, the severity of the infection to which they give rise in highly susceptible animals. These tests must be carried out with animals which possess no immunity, inherited or acquired, against these diseases; and these have to be obtained from tick-free countries. For this purpose eighteen bulls were imported during the year from Great Britain. These were far more costly than was necessary for the experiments—indeed, experimental risks could not be taken

with such valuable animals—but the overhead costs of freight, railage, etc., being the same, no matter what the cost of the animal, it was thought best to obtain in this way bulls which could subsequently be distributed to farmers for the improvement of their herds. Twelve of these bulls were sold after inoculation at approximately £1,000, so that the cost of the experiments was not as great as it appeared. Fortunately, with the first series of tests, a virus of suitable strength was found, and this has been applied with considerable success. Nevertheless, it is admitted that there is urgent need for an improved method of inoculation. The High Commissioner, who is seeking markets for Rhodesian products, has recently drawn attention to the need for increasing the number of our cattle from two to six millions, but as indicated elsewhere in this report, not only the quantity but the quality of our stock must be improved if they are to find a place in the world's markets. This can only be brought about by mating our local stock with well-bred bulls, the majority of which must be imported from overseas, and will be susceptible to tick-borne diseases unless artificially protected against them. Many thousands of such animals are necessary if the cattle industry is to be developed along the right lines, but under existing conditions there are few who can afford, even with the assistance of the Empire Marketing Board, to import animals to die on exposure. Even animals bred locally on farms where ticks have been eradicated by systematic dipping die when moved to tick-infested areas, and local breeders of pure-bred and grade bulls find it difficult to find a market for their animals unless inoculated. Until the whole country has been entirely freed from ticks, these difficulties must continue, and unless an improved method of conferring protection against tick-borne diseases can be discovered, progress will be as slow as in the past. It would appear, therefore, that research in this direction is a matter of some importance.

(To be concluded.)

Vegetable Growing in Southern Rhodesia.

LETTUCE.

By G. W. MARSHALL, Horticulturist.

[It is the intention of the Horticulturist to write a series of articles for this Journal on the subject of vegetable growing, the first of which appears below. To those who contemplate the growing of vegetables on a commercial scale, we would issue a word of advice—study your markets, grow what is required and do not over-produce. —Ed.]

Lettuce is by far the most important of our salad crops and it may be regarded as the most profitable when correctly grown.

Climatic Requirements.—Notwithstanding the fact that lettuce is a cool weather plant it may be grown in Southern Rhodesia throughout the year, but shade, either natural or artificial, is essential during the hot summer months. Light sapling frames covered with tobacco seed bed cloth will provide ideal shade.

Soil.—Most soils are suitable for lettuce, but medium sandy loams are best. High quality and crisp lettuce can only be obtained when the soil is well prepared and an adequate amount of plant food and water provided.

Fertilising.—One heaped wheel-barrow load of well-rotted kraal manure is sufficient for 10 square yards of soil. It should be well worked into the upper 9 inches of soil; this may be accomplished by one or two careful diggings. A complete garden fertiliser can with advantage be applied at the rate of 1 pound per 5 square yards; it should be broadcasted over the soil after the first digging and then worked in at the second digging. The amount of manure and fertiliser recommended is usually ample to produce a large, well-grown, crisp lettuce, but should any check occur in the growth of the crop it may become advisable to apply 4 ounces of nitrate of soda to 10 square yards of lettuce bed. This application should be made in liquid form, and may be done by dissolving the nitrate of soda in water, then sprinkling it over the beds with a watering can, using 1 tablespoonful of nitrate of soda to 4 gallons of water, and applied at the rate of 16 gallons to 10 square yards of lettuce bed.

Preparation of Beds.—If the soil preparation has been thorough, the beds may be made 3 to 3½ feet in width, with length optional. The beds should be raised about 3 inches above the intervening paths. This is essential during our wet season, as the surplus moisture is then able to drain from the beds. When irrigation is practised the beds may be at a lower level than the paths, but this is dangerous, particularly so if an unexpected wet period should occur during the growth of the plants. Raised beds are advised, and if an additional 3-inch mound is made along the sides and ends of the beds the irrigation water will be retained and no danger of flooding will occur.

Seed Planting.—The seed may be planted in small beds or frames and then transplanted when 2 or 3 inches in height. Lettuce seed is small and it should not be planted deeply—¼ inch is sufficient. The seed (if fresh) will germinate in five to seven days and the plants will be fit to transplant in three to six weeks after germination. The usual distance for planting lettuce is 9 to 12 inches between the rows and 6 to 9 inches between the plants in the rows. All transplanting should be done during the cool of the day. The plants should be well watered daily until they are well established. Lettuce seed may be planted

in situ, thus obviating transplanting. Space the rows about 10 inches apart lengthwise on the beds to be planted; this distance will permit of four rows being planted on a 3 feet 6 inches bed. A suitable drill may be used by drawing the reverse end of a rake handle along a garden line set where the row is to be. This will produce a small shallow drill of about 1 inch in width and half an inch in depth, along which the seed is sown. One ounce of good fresh seed will be sufficient to seed about 200 feet of drills. After the seed sowing is completed, close the drills by reversing the rake head and drawing it lightly along the rows; then cover the beds with a light layer of grass or straw and water daily until the seed germinates, after which remove most of the straw, only retaining sufficient to form a light mulch through which the plants can grow. When plants are about 1 inch in height they should be thinned down to 2 inches apart in the rows, and when 2 to 3 inches high a second thinning to 4 or 6 inches apart, according to season or variety. The plants removed at the second thinning may be transplanted to other beds or interplanted amongst cabbage or other crops that are still small and do not require all of the space provided for their maximum growth. This interplanting of lettuce between slow maturing crops is advised whenever it can be practised.

Planting Season.—Lettuce may be planted throughout the year. Monthly sowings should be made to furnish a continuous supply, but plantings made during May to July will be found rather slow in maturing. This condition may, however, be overcome by sheltering the beds, with grass or other suitable screens, from the cold and drying winds. The November to January plantings are often affected by heavy and continuous rains, and this condition may be ameliorated by fixing the summer shades at an angle to enable the excessive moisture to fall between the beds.

Watering.—Lettuce requires a large amount of water and the plants must not suffer in this respect. Where irrigation is practised the plants should be watered every second or third day, and with hand watering every day. All water should be applied during the cool of the day.

Cultivation.—Lettuce will respond to a light loosening of the soil after each watering. A small three-pronged (Norcross) type of cultivator is ideal for this work. This

stirring of the surface soil is unnecessary where a mulch of decayed vegetable matter is used.

Varieties.—The self-closing cabbage varieties are most popular among Rhodesian consumers, but each grower must test the various varieties and find those most suited to his soil and climate. Most varieties do well, but Webb's Wonderful and Sutton's A.1 are well worth planting. Of the Cos or erect-growing type, Balloon is possibly one of the best, but Cos varieties are as a rule very disappointing.

Marketing.—It is not advisable to grow lettuce commercially unless it is possible to place it on the market within a few hours of harvesting. The plants should be harvested when well grown but crisp, and then packed carefully in light crates or baskets. All old or dirty leaves must be removed when harvesting; the plants may also be immersed in clean water and drained before packing. Harvesting may be done early in the morning for local markets.

Salisbury Agricultural Experiment Station.

ANNUAL REPORT, 1929-30.

By H. C. ARNOLD, Manager.

(Published with the approval of the Chief, Division of Plant Industry.)

The season under review was by no means a favourable one for crops, and particularly for maize. The first effective rain fell on 22nd November; after that the precipitation was adequate and fairly evenly distributed until the end of January, excepting for a rainless period between 24th December and 10th January. During February, however, only one fall exceeding .25 inch was recorded, and the rain which fell after 7th March was of little value for the production of crops.

The favourable conditions at the beginning of the season encouraged the production of much leafy growth, which became a liability instead of an asset during the droughty period which followed, and as this coincided with the flowering stage of the maize crop, it is probable that the yields might have been heavier had the early growth been less luxuriant.

The total of 1.88 inches for February is the smallest precipitation recorded for that month for several years.

Analysis of Rainfall, 1929-30.

Month.	No. of rain days.	Total for month.	No. of rains over ½ inch.	Total to end of month.	Periods exceeding one week without rain.
		Inches.		Inches.	
October	4	0.84	1	0.84	31st October to 10th November
November ...	9	4.28	4	5.12	12th November to 20th November
December... ...	15	7.24	6	12.36	24th December to 9th January
January	17	5.10	8	17.46	
February	8	1.88	2	19.34	1st February to 11th February
March	11	3.75	6	23.09	16th March to 27th March
April	5	0.37	...	23.46	
	69	23.46	27		Five periods of seven days or over

The results of experiments conducted at this station since 1919-20 are available for reference in bulletin form, and to facilitate comparison this report is drawn up on similar lines to previous ones.

Having served their purpose, the following experiments have been discontinued:—

(1) Maize on land manured with "Adco" manures *versus* farmyard manure.

(2) Maize under-sown at the last cultivation with legumes for green manure.

(3) Maize variety trials.

(4) Potato variety trials.

Wheat variety trials have been much reduced.

New investigations commenced include:—

(1) Raw phosphate rock applied to a green manure crop compared with superphosphate applied direct to the maize crop following the green manure.

(2) The relative value of the phosphatic fertilisers —namely (a) raw phosphate rock, (b) superphosphate (19% P_2O_5), (c) raw phosphate rock

and superphosphate in equal proportions, when applied to a green manure crop to be followed by maize.

(3) Frequent *versus* less frequent green manuring in rotation with maize. The land will be green manured at three-, four- and five-year intervals, and will carry maize during the intervening years. The same amount of fertiliser is applied in each case. Three plots are assigned to each method, and within the various groups the green manure crop will be grown in different years, in order as far as possible to overcome the varying seasonal influences.

(4) The relative value of the following crops for green manure:—(a) common Sunn hemp; (b) dwarf Sunn hemp; (c) sunflowers; (d) an early crop of Sudan grass ploughed in, followed by a second crop of Sudan grass and Sunn hemp. This experiment links up with investigations into the control of witch-weed.

(5) Sunn hemp for seed:—(a) effect of pruning the plants at different stages in their growth; (b) distance planting trials; (c) the isolation of promising seed-producing strains.

(6) *Sesbania* species *versus* Sunn hemp for green manure.

(7) Edible canna in rows six feet apart, inter-planted with various legumes, for grazing by pigs.

CROP ROTATION EXPERIMENTS.

First Series, 1913-30.

Maize Yields in Bags per Acre.

System of cropping.	1929-30. Rainfall 23.46 inches.	1928-29. Rainfall 31.62 inches.	1927-28. Rainfall 26.63 inches.	1926-27. Rainfall 22.39 inches.	1925-26. Rainfall 33.08 inches.	Average yields.
‡ A1. Maize continuous (green manured plus 250 lbs. per acre bone meal and 19 per cent. supers in 1928-29), 17th year	15.88	Green manure ploughed under	1.90	5.25	7.80	6.28 (16 yrs)
‡ A2. Maize continuous, 250 lbs. per acre bone & supers to the maize in 1928-29, 17th year	11.44	6.20				
B. Alternate maize and bare summer fallow—no manure or fertiliser	6.43	5.65	8.15	10.20	16.30	10.52 (15 yrs.)
C. Three-course rotation — maize, velvet beans (reaped), oats. No manure or fertiliser	11.36	12.00	12.15	16.90	15.50	14.98 (15 yrs.)
D. Four-course rotation —maize (plus 6 tons dung per acre), oats, velvet beans (reaped), maize. Average of two maize plots	15.79	19.00	17.45	23.45	24.80	
Maize (no manure direct)	13.25	21.35	14.10	24.80	24.40	18.55 (14 yrs.)
Maize (dunged plots)	18.33	16.65	20.80	22.05	25.20	20.34 (6 yrs.)

‡ Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields had gradually decreased until they had become so low as under practical field conditions to have rendered them negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone meal and two-thirds superphosphate, at the rate of 250 lbs. per acre, at the beginning of this season. One half of the plot was then planted to maize, while the other half was sown to a mixture of Sunn hemp and velvet beans for green manuring.

The remarkable rise in the yield of the maize plot from 6.2 bags to 11.44 bags per acre shows the beneficial effect which the application of 250 lbs. of bone and superphosphate has had. It was mentioned last season that the maize crop on this plot appeared to lack the nitrogen necessary to enable

it to make the fullest use of the phosphate supplied. With the decay of the bone meal some nitrogen has become available, and it appears that nitrogen-fixing bacteria have increased with the application of phosphates, and in this way sufficient nitrogen to produce a crop nearly twice as large as last year's has been obtained. There is an even more striking increase in the yield of the plot which received both green manure and fertiliser, which illustrates how highly beneficial it is to combine the two treatments. Although the yield of 15.88 bags from the part of the plot which was green manured does not quite equal the total yield over two seasons of the part of the plot which received fertiliser only, it must be remembered that one heavy crop can be handled more economically than two lighter ones, and that the benefit conferred by the combined treatment may be expected to continue over a longer period than that of the fertiliser alone.

Rotation "B."—This experiment has afforded no evidence of increased fertility having resulted from the practice of bare fallowing, and as this system exposes the land to the very harmful effects of soil erosion, it cannot be recommended. The yield of 6.43 bags per acre given in the tabulation is really the amount yielded by this land over a period of two seasons, and thus the annual return is only half that amount. The low yields obtained during recent years show that the production of maize under this system would be quite impracticable, and because of this dolichos beans for hay instead of bare fallow will alternate with maize on these plots in future.

Rotation "C."—The yields obtained in this system form a very striking contrast to those from Rotation "B." The benefits to be obtained from a balanced system of crop rotation are here clearly demonstrated. On most farms where a system of this kind was practised the oat crop would be fed to live stock, and consequently a quantity of yard manure would be available for maintaining the fertility of the land, and heavier crops than those recorded here might be expected. During the past few years the dry vines of the bean crop have been ploughed under after the crop of seed has been reaped, and a small amount of humus has been added to the soil in this way, but no other manure or fertiliser

has been applied to these plots since the land was first broken some 20 years ago.

Rotation "D."—The cropping power of this land has been maintained at a remarkably high level by the system being practised, which includes the application of the comparatively small amount of 6 tons of farmyard manure every fourth year. It is rather surprising that the yields of the maize crop which occupies the land in the fourth year after the kraal manure is applied are slightly higher than those of the crop immediately following the application of the manure. Thus the plot which yielded 21.35 bags in 1928-29 without manure yielded only 18.33 bags after the manure was given in the following year. Apart from showing that the beneficial effect of the manure continues over a number of years, it also shows that the oats and beans remove relatively small amounts of plant nutrients from the soil—the bean crop indeed appears to exert on the following maize crop a beneficial influence comparable with that of kraal manure.

It is well known that both oats and beans furnish stock food of higher feeding value than the maize crop. The rotation indicates, therefore, that farmers who can utilise oats and beans for stock food may find it more profitable to limit their acreage under maize and grow more of the other crops. By this means the fertility of the soil can be maintained at a fairly high level, while purchases of fertiliser and protein-bearing feeding stuffs to "balance" the ration may be reduced to a minimum.

CROP ROTATION EXPERIMENTS.

Second Series.

When these rotations were laid down in 1919-20, maize was the only crop being grown for the overseas markets, and they were intended to meet the needs of farmers who could not adopt a system of mixed farming. The series includes two plots A and F on which maize was grown continuously for 10 years without manure or fertiliser to check the results of the rotation trials. For this purpose the cropping of Plot A will continue as in the past, but in future on Plot F, beginning with this season, fertiliser will be applied in alternate years. The fertiliser treatment given to this plot

will be the same in quantity and quality as that in rotational system "H," but green manure will not be included.

The maize yields in these rotations, which are now in their eleventh year, have declined considerably of late, and it was deemed advisable to increase the amount of plant food supplied by the addition in each system of 200 lbs. per acre of superphosphate in excess of the original fertiliser treatment planned.

Plot A. System "E."

Maize continuous without manure or fertiliser.

Seasons and Yields of Maize in Bags per Acre.

1929-30.	1928-29.	1927-28.	1926-27.	1925-26.	Average over 11 years.
7.85	7.65	6.5	10.6	12.0	12.39

Plots B to E. System "F."

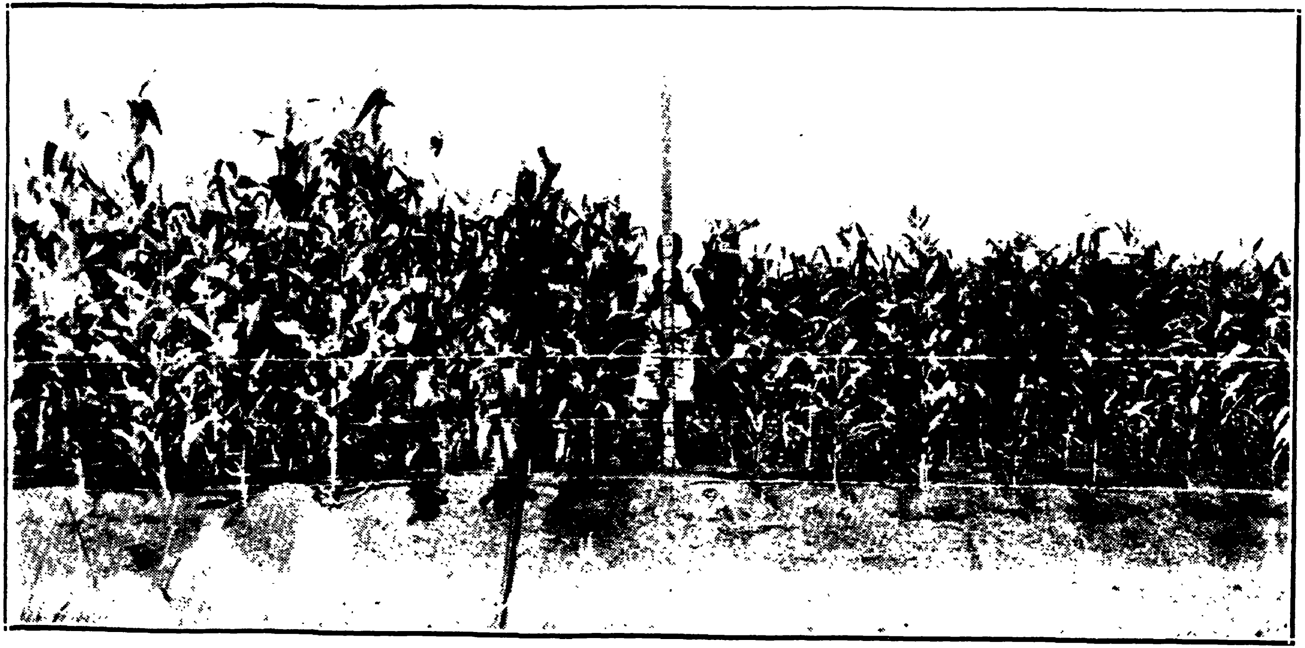
Three-quarters of the land under maize, one-quarter under Sudan grass. Each year one section under maize, commencing with Plot B in 1919-20, receives 8 tons of farm manure per acre, and commencing on Plot E in 1929-30, the section which grew Sudan grass the previous season receives 200 lbs. per acre of superphosphate (19% P_2O_5).

Maize Yields in Bags per Acre.

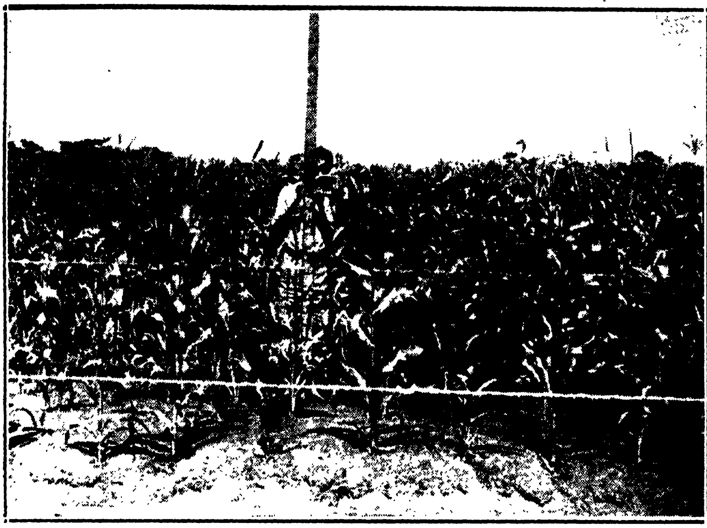
	1929-30	1928-29	1927-28	1926-27	1919-20	Average 1920-30
Plot B	Sudan	14.55	17.00 †	18.15	26.0	19.34
,, C	13.33	10.15 †	8.50	Sudan	23.0	15.40
,, D	15.78 †	9.55	Sudan	16.25	Sudan	18.01
,, E	13.90 ‡	Sudan	11.60	20.30	24.6	16.72
Average ...	14.34	11.42	12.36	18.27	24.7	17.37

† Indicates the application of farmyard manure.
‡ Indicates the application of 200 lbs. per acre superphosphate.

The beneficial effects of the kraal manure are clearly shown by these results. On Plot C the yield was 8.5 bags in 1927-28, but the manure increased it to 10.15 the following



Maize Continuous. First Series of Rotations.—On the left, maize (1930-31 crop) following a fertilised green manure crop in 1928-29. On the right, the same amount of fertiliser was applied to the maize grown in 1928-29, but the land has not been green manured.



Maize Continuous. First Series of Rotations.—The 1930-31 maize crop on the section of the plot which received fertiliser only in 1928-29.

Maize Continuous. First Series of Rotations.—A closer view of the 1930-31 maize crop on the green manured portion of the plot.

season; this was further increased to 13.33 bags in the season following the application of manure. Results obtained in this experiment (not included in the table) show that although the manure may have been fairly well rotted down before it is put on to the land, it is often slightly more effective during the second season after its application than the first. The application of superphosphate appears to have raised the average yield of these plots by two or three bags per acre above that of the past two seasons, but it is still little more than half that of the year 1919-20, when the trials were commenced, showing that the 8 tons of farmyard manure applied at intervals of four years is insufficient to maintain fertility at its original level when maize is grown almost continuously. The rotation provides an interesting comparison with the four-course system in the first series.

Plot F. System "G."

Maize continuous. No manure or fertiliser during the first 10 years. Commencing season 1929-30, fertiliser consisting of one-third bone meal and two-thirds superphosphate at the rate of 200 lbs. per acre applied.

Seasons and Yields of Maize in Bags per Acre.

1929-30.	1928-29.	1927-28.	1926-27.	1920-21.	1919-20.	Average over 11 years.
6.38	6.1	4.8	9.63	24.2	23.3	11.77

Having served its purpose under continuous maize without the addition of manure or fertiliser of any kind, a commencement was made this season of applying fertiliser to this plot of the same kind and in the same quantities as that used in System "H" below, but in this case no humus, either in the form of farmyard or green manure, is given. In this way information regarding the practicability or otherwise of profitable maize production on soil lacking humus though amply supplied with phosphates will be obtained. The yield of 6.38 bags this season is seen to be little more than last year's, and is actually 1½ bags less than that of Plot A in spite of the application of fertiliser.

This corroborates the results obtained in System "A" in the first series of rotation trials.

Plots G to K. System "H."

Three-quarters of the land under maize, one-quarter under velvet beans, which are ploughed under for green manure. From the commencement of the experiment until last season this land received green manuring and one application of fertiliser during each period of four years. The returns from these plots shown that insufficient plant food has been supplied to maintain the fertility of the land, and the manurial system has been changed to provide for two dressings of fertiliser during each four-year period. The crop of maize which follows the green manuring now receives 200 lbs. of superphosphate per acre, which should enable it to make better use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, while the third crop—that immediately in front of the green crop —receives 200 lbs. per acre of a mixture of bone meal and superphosphate. Under the revised system it is anticipated that heavier green manure crops will be available for ploughing under, and this combined with the additional application of artificials should result in a satisfactory maintenance of soil fertility.

Yields of Maize in Bags per Acre.

	1929-30	1928-29	1927-28	1926-27	1925-26	1919-20	Average 1919-30
Plot G ...	Beans	8.75	14.50 †	17.90	Beans	23.10 †	15.89
,, H ...	10.70 †	9.00 †	14.40	Beans	13.80	23.00	15.56
,, J ...	7.57	17.50	Beans	14.20	15.80 †	Beans	16.19
,, K ...	16.00 †	Beans	7.80	14.70 †	20.20	19.20	15.40
Average ...	11.42	11.75	12.23	15.60	16.60	21.70	15.76

† Indicates application of fertiliser.

Owing to the alteration in the fertilising scheme, Plot H has received 200 lbs. per acre of bone and supers in two consecutive seasons, but in spite of this liberal treatment the yield is much below that of the crop grown on this plot in 1927-28 following green manure. The above tabulation shows

that the heaviest yields are invariably obtained from the crop which follows a green manuring, and that during recent years the plot which receives the fertiliser has failed to respond as well as formerly. It appears certain, therefore, that either the nitrogen or humus content of the soil on these plots is now the limiting factor in crop production.

GREEN MANURING WITH IMMATURE *VERSUS* MATURE CROPS.

Investigators have shown that leguminous crops in general enrich the soil to a small extent only after the flowering stage has been reached, and in some cases a large part of the nitrogen previously collected is used up in the formation of seed. It would appear, therefore, that in respect of the nitrogen little is to be gained by allowing the crop to continue its growth after the flowering stage is reached. The results of previous experiments on these lines have indicated an appreciable difference in favour of "mature" green manure crops, and the past season's work corroborates those results.

The "immature" crops were ploughed under as soon as the first flowers opened, while the crop was deemed to be "mature" when it had reached its maximum growth. At this stage some of the seed had become fully formed, but some months would have elapsed before the plants would have reached maturity in the sense that they were ready to harvest for seed.

In one series of four plots Sunn hemp was used, and in the other series velvet and dolichos beans were sown together. The average amounts of green material ploughed under in each case were as follows:—

	Date immature crop ploughed under.	Green material, lbs. per acre.	Date mature crop ploughed under.	Green material, lbs. per acre.
Sunn hemp ...	15th January, 1928	3,200	28th February, 1928	12,550
Velvet beans ...	9th February, 1928	7,743	28th March, 1928	15,000

The average yields of maize reaped from each pair of plots during two seasons are as shown in the following table.

Yields of Maize in Bags per Acre.

		Immature crops.	Mature crops.	Difference in favour of mature crops.	Totals.
Sunn hemp ...	1928-29	14.27	16.69	2.42	+ 3.20
	1929-30	19.53	20.31	0.78	
Velvet beans ...	1928-29	14.97	17.25	2.28	+ 3.00
	1929-30	21.24	21.96	0.72	

The results seem to indicate that the benefit conferred by the green manuring is not due to the addition of nitrogen only, but that the amount of vegetable matter which is ploughed under is of equal and possibly of greater importance. The returns show also that by delaying the ploughing under of the crop by five to six weeks an additional three bags of maize per acre have been obtained over a period of two years.

Fortunately seed of the crop used for green manuring in this Colony can be sown before the seasonal rains commence. Thus when this operation is completed early, there is not only more time available for planting the main crops, but well-matured green manure crops will be ready for ploughing under while the soil moisture is sufficient to cause rapid decomposition of the vegetable matter in anticipation of the next season's programme.

MAIZE DISTANCE-PLANTING TRIALS.

Yields of Maize in Bags per Acre.

Distance of planting.	Number of plants per acre.	1929-30 rainfall, 23.46 inches.	1928-29 rainfall, 31.62 inches.	1927-28 rainfall, 26.63 inches.	1926-27 rainfall, 22.39 inches.	1925-26 rainfall, 33.08 inches.	1924-25 rainfall, 52.28 inches.	Average over 6 years.
Ins. Ins. 24 x 15	17,424	16.68	13.76	12.28	17.00	12.4	23.1	15.62
24 x 18	14,520	17.88	13.52	15.50	17.36	14.2	19.7	16.49
30 x 15	13,939	17.50	13.76	15.00	19.53	17.5	23.1	17.47
30 x 18	11,616	17.92	14.12	16.24	19.13	18.2	20.4	17.61
36 x 15	11,616	17.08	16.64	16.16	18.24	18.5	20.1	17.26
36 x 18	9,680	17.00	16.74	17.08	18.69	17.5	20.3	17.43
40 x 15	10,454	15.20	16.40	15.44	16.68	16.6	17.0	16.18
40 x 18	8,712	15.64	17.20	15.60	16.56	16.2	17.2	16.35

These trials have been carried out on lines suggested by Mr. H. B. Christian, of the Enterprise district. Each method of spacing has been tested on duplicate plots over a period of six years, and thus the results given in the last column are the average yields of twelve plots. The heaviest yields have consistently been obtained at a somewhat closer spacing than is generally practised, but as there is a difference of less than ¼ bag per acre between the yields of the plots where the rows were spaced at 30 inches apart and those spaced at 36 inches apart, it is obviously more economical to plant at the wider distance.

The yields obtained from these plots are considerably higher than those usually obtained by farmers, and although they are in part due to almost perfect stands, they indicate also that the soil of these plots is somewhat more fertile than that of the average maize farms.

It is reasonable to assume that on less fertile soil a somewhat wider spacing than 36 inches between the rows may be found to be the most economical, because, while the yields at the wider spacings would probably be as great as those obtained at an espacement of 36 inches, the operations of

sowing and cultivating can be considerably accelerated by increasing the distance between the rows.

The figures in the last column show that the plots on which the maize was sown at 18 inches apart in the row yielded about $\frac{1}{8}$ bag per acre more than those spaced at 15 inches apart. Although this difference is common to all plots, it represents a very small proportion of the total yields, and is believed to be due to variation in soil fertility rather than to espacement differences.

(To be continued.)

AT STUD.

The thoroughbred stallion Dark Dragoon is available for stud purposes. Service fees, £1 1s. per mare, plus 1s. per day for feeding, stabling and attendance. Only mares of *bona fide* farmers will be accepted. Service application forms and further particulars may be had on application to the Principal, Matopo School of Agriculture, P.B., Bulawayo.

Re-stacking of Maize Rejected for Export on account of Excessive Moisture.

At the seventh Maize Grading and Export Conference recently held in the Department of Agriculture, it was decided that in future any maize rejected for export by the grader on account of it containing 12.8 per cent. or more of moisture would not be re-examined for at least twenty-one days, unless in the meanwhile it had been re-stacked in accordance with instructions to be issued later.

Farmers are now warned that this decision will be adhered to strictly, and that under no circumstances whatever will exceptions to the rule be considered.

Two alternative methods of stacking may be adopted as follows:—

Vide *Illustration No.* 1.—The bottom layer of bags are laid on the dunnage on their broader sides, and the next tier is placed with their narrower sides resting in the depressions which occur where the bags in the lower layer meet each other. The third tier is arranged similarly to the first, and the fourth tier similarly to the second, and so on until the stack is five or seven tiers—no more—in height.

Vide *Illustration No.* 2.—The illustration indicates the slight variation in the method of stacking which exists with this system. The bottom layer of bags is arranged in the same manner as previously described, but the bags in the second tier are placed on edge, each in the centre of a bag in the lowest tier. The third tier is slightly over-lapped, the edges of every two bags meeting in the centre of the bag standing on edge below. A similar arrangement is followed for the remaining tiers until the stack reaches the required height. Farmers are recommended whenever possible to make the stacks not more than five tiers high, as

at this height they are less liable to collapse and grading is rendered easier.

The second method of stacking has a slight advantage in respect to the passage of air around the bags, but the stack requires more care in building, and even then is somewhat liable to collapse, in which case bags are prone to burst and grain to be wasted; re-stacking will be necessary before the consignment can be graded, and at the worst personal injury may occur to persons working on or around the stack.

In general, therefore, method No. 1 is recommended, except when the grain is excessively wet and must be dried out in the shortest possible time.

Bagged maize stacked during the dry winter months under either of the above systems dries out more rapidly than under any other system so far devised. An instance of this may be quoted. Last season a certain consignment stacked in the usual manner was rejected on account of excessive moisture. It was left for two months, and even at the end of that time still contained 12.9 per cent. of moisture. It was then re-stacked in the manner described in No. 1 above, and in seven days had dried out sufficiently to pass the test.

Should any portion of the crop already delivered to the railway line be found to be excessively moist, growers are advised to discontinue riding to the railway until they have submitted a representative sample of the remainder of the grain for moisture test, and have, if necessary, re-stacked the undelivered balance of the crop on the farm.

Re-stacking either on the farm or on the railway cannot but entail considerable added expense, *and the remedy for the need of such measures lies in the grower ensuring that the wettest of his grain is dried out to within at the utmost .2 per cent. of the maximum permitted for export before he commences delivery to the railway line.*

Appeal against Graders' Decision.—Some uncertainty appears to exist as to the steps which a grower can take when he considers that his maize has been wrongly rejected on account of excessive moisture or other cause. The following provision for appeals is made in clause 9 of the Produce

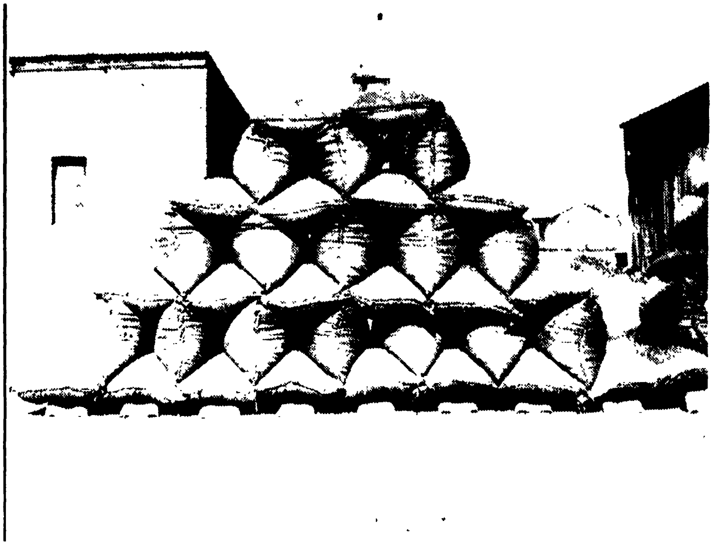


Fig. I.
Method of stacking wet maize to hasten drying.

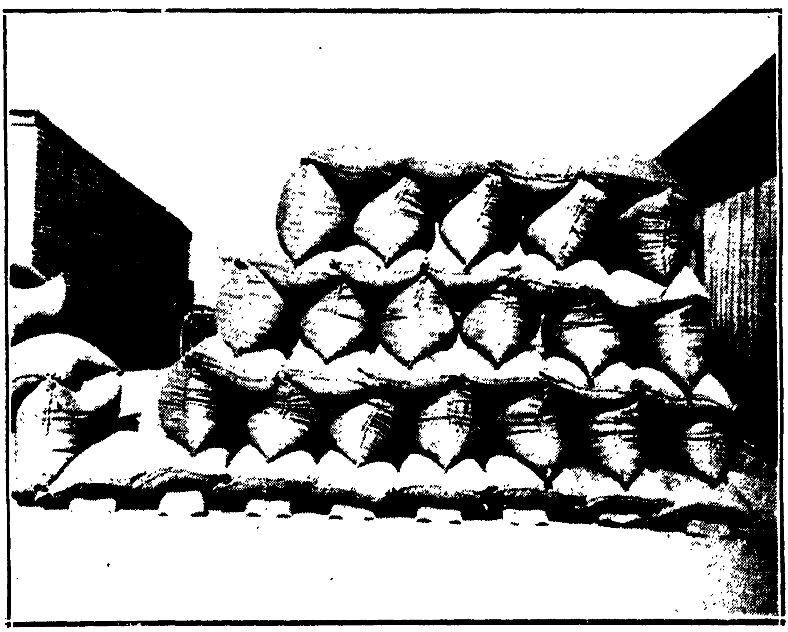


Fig. II.
Method of stacking wet maize to hasten drying.

Export Ordinance of 1921, and is republished here for general information:—

> "Any owner of produce intended for export, being dissatisfied with the decision of or action taken by an inspector under this Ordinance, may appeal to the Controller against such decision or action. A further inspection shall thereupon be made by the same or another inspector. If, as the result of such inspection, the decision or action appealed against be altered in favour of the appellant, no fees shall be charged for such second inspection. If the owner is still dissatisfied with the decision or action of the inspector, he may appeal to a board to be appointed by the Administrator. Before the matter is referred to the board, the person appealing shall deposit at the office of the Controller such a reasonable amount as in the Controller's opinion will be sufficient to defray the costs of the appeal. Such board shall consist of three members, of whom one shall be the Controller and at least one shall be directly interested in the kind of produce giving rise to the dispute, and its decision shall be final. The costs of the appeal shall be in the discretion of the board."

A number of appeals have been made during the last few years to the Controller (the Chief, Division of Plant Industry), but in comparatively few cases has the owner been found to be right and the grader wrong. No appeals to arbitration have thus far been made in this Colony, and it is hoped that the expense of such a course will not be found necessary in future.

Much, if not all, of the difficulty experienced in regard to over-moist maize can be overcome by the grower exercising greater supervision when harvesting, and by learning to judge the moisture content more accurately. This last can be achieved by submitting samples to the Department for test and by retaining on the farm in an air-tight receptacle part of the same sample for comparison when the result of the test is communicated.

Hints to Poultry Breeders.

THE COLD WEATHER.

Issued by the POULTRY BRANCH.

With the advent of cold weather, especially cold nights, it is necessary, in order to keep up the egg supply, to see that the birds are warm and comfortable. All iron houses, and those with iron roofs, should be covered with grass to prevent a sudden drop in temperature during the night. All houses in exposed positions should have blinds, which are easily made of pieces of old sacking neatly sewn together. These can be dropped over the wire netting in front of the house at sunset, and rolled up each morning.

As a rule in Rhodesia the weather for rearing chicks during the hatching season is most suitable, but occasionally we get a cold snap. Breeders must use their own discretion as to whether it is necessary to use artificial heat or not in the brooder.

Internal parasites are one of the causes of infertile eggs. Although poultry parasites are no more common in this country than in others, few poultry keepers realise the extent to which they are present among their fowls. Whenever fowls appear out of condition the first thing to ascertain is whether they are subject to worms.

Cleanliness of the fowls, their houses and surroundings should be strictly adhered to. Plenty of sunlight and fresh air should penetrate to all parts of the houses; the former is the best germicide we have. Dark, stuffy, ill-ventilated houses are the breeding grounds for poultry parasites, and yet how many of such do we still see in this country! It is no wonder the birds are out of condition and unprofitable.

Periodical spraying of the interior of the houses and fittings should be carried out with the following mixture:—Four tablespoonsful of Kerol, Hycol, Izal or a similar disinfectant to 4 gallons of hot water.

The main method of prevention is similar to that which should be adopted in the case of all diseases, viz., by selecting birds of marked vigour and stamina as breeders, thus producing a strain of birds of high resistance to disease and other disorders and invasions of parasites. The birds should all be carefully examined, and all which show suspicious symptoms should be isolated. The droppings of these should be either burned or treated with lime. Where infestation with worms is experienced, all the birds should be moved on to fresh ground. Spray the house and fixtures with a solution of 50 lbs. of lime to about 50 gallons of water. Apply a dressing of unslaked lime to the soil of the old run and dig it in so that it is thoroughly incorporated. All food and water utensils should be cleaned daily with a solution of some disinfectant and water.

Maize Yields of the Gwebi Farm.

Mr. J. H. Hampton, now of the Department of Lands, who was manager of the Gwebi Farm during the years 1914 to 1925, is of opinion that the maize yields prior to 1925, as given in the article entitled "The Gwebi Demonstration Farm," which appeared in the February issue of this Journal, are misleading. He recalls that during those years certain poor land on the eastern side of the farm was maintained under cultivation and a portion of it annually grew Hickory King maize. This fact, he considers, appreciably reduced the average yield of the farm. The field was abandoned in 1924, by which time other land of somewhat higher fertility and

more conveniently situated to the other arable fields had been broken up.

Mr. Hampton draws attention to reports published in the Journal during the period, which indicate that much higher yields than 6 to 7 bags an acre were obtained from Salisbury White maize grown on the best land, namely, "broadbalk," which is still under cultivation and now comprises blocks A, B and C of the arable land.

In 1914-15 this variety yielded as heavily as nearly 18 bags an acre on certain fertilised plots, and without fertiliser returned an average of 12½ bags an acre, while the average for the whole 187 acres that year under maize was nearly 10 bags an acre.

In 1915-16, fertilised plots averaged 9.26 bags an acre over 27 acres, and only in 1916-17—an unfavourable season—did the rotation plots yield as low an average as 7.3 bags an acre.

According to the *Rhodesia Agricultural Journal* of December, 1919, Salisbury White maize over 114 acres in 1918-19 averaged 10.4 bags an acre, with 13.2 bags an acre on the rotated and fertilised plots.

Dislocation of work at head office, due to the Great War, led to an absence of reports on the farm for the years 1917-18 and 1919-20, and records of these seasons are therefore unavailable. But in 1920-21, 83 acres of Salisbury White maize on second year land, without treatment, is reported in the *Rhodesia Agricultural Journal* of December, 1921, to have averaged 12½ bags an acre, while as much as 18.3 bags an acre was obtained over 15 acres of fertiliser trials and 10.9 bags an acre over 22½ acres of second year residual fertiliser trials.

Kudzu Vine Pastures.

By the Division of Plant Industry.

The following notes from the *International Dairy Goat Journal* on the subject of kudzu vine are of particular interest to Rhodesian farmers. The plant has proved itself admirably adapted to local conditions in this Colony, and on good land it appears to grow every bit as well here as it apparently does in Florida.

The slow rate of establishment of the crop from *seed* or *cuttings* has discouraged many Rhodesian farmers from giving serious attention to this valuable fodder. But propagation from roots or crowns has proved to be entirely satisfactory, and, with good treatment and within eighteen months, crowns planted 6 feet x 6 feet apart should produce a solid mass of vegetation 18 to 24 inches high.

In Rhodesia, kudzu prefers a fairly fertile soil and thrives best in the districts of higher temperature. It remains dormant during the three or four coldest months of winter, but for the rest of the year grows vigorously. Once well established, it does not suffer seriously from attack by termites and is known to do well on heavy red dolerite and on lighter contact soils:—

PERPENDICULAR KUDZU PASTURES.

By Charles F. Leach, Monticello, Florida.

(*The International Dairy Goat Journal*, December, 1930.)

Dairy goat breeders and raisers can provide an ideal pasture for their stock by building three-strand wire fences in parallel rows three feet apart and planting three-year-old kudzu roots under each fence, three feet apart in the row. The kudzu vines should completely cover these fences in about three months. The second year they will make a solid mass of the most nutritious pasture in the world, filling the entire space between the fences by 1st May in the

south and by 1st June in the north. The fences should be six feet apart.

Kudzu makes an absolutely permanent pasture; never has to be replanted and is never a pest. Kudzu is a legume, but never bloats any kind of live stock, and needs no lime, fertiliser or inoculation. It will grow on very poor, acid soil. It needs a well-drained soil, but it is very drought-resistant. *Cappers' Farmer* says it thrives in Kansas, Nebraska and Oklahoma, wherever there is 15 to 20 inches of rainfall.

Kudzu hay contains four per cent. more protein than alfalfa. It is perfectly hardy on a well-drained soil. It is now grown from Canada to the Isthmus of Panama.

One hundred good three-year-old roots will plant three fences 100 feet long, occupying 900 square feet of space and furnishing pasture all summer to at least three goats and several kids. One thousand roots will plant 30 rows 100 feet long, and will furnish plenty of pasture for 20 goats and all their kids. If kids are pastured on perpendicular pastures, it may be wise to use three or four feet woven wire fences at the bottom with a barbed wire above.

The goats should be turned into one alley at a time. When that is grazed down to six inches from the fence, turn them all into the next alley, and so on. This gives kudzu a chance to grow again in the alley first grazed, and if you have enough alleys for the number of goats there will be a continuous supply of tender, nutritious feed all summer. On Cherokee farms, at Monticello, Florida, where these perpendicular pastures were invented, five head of pure bred Jersey cows are pastured seven or eight months in the year on three-quarters of an acre. They keep fat and give a full flow of milk without any other feed.

For rabbits and chickens the kudzu should be planted without fences, unless you want to cut it off the fences and feed it. When grown for hay, of course, no fences are needed.

When a farmer has plenty of land he does not need perpendicular kudzu pastures, as it can be planted in seven-foot rows and three and a half feet apart in the rows. If cultivated about three times, laying by the land as smooth

and flat as possible, the kudzu will make long propagating runners out over the land and peg down at every joint, which are from twelve to sixteen inches apart. As good three-year-old roots will each make a dozen or more of these long runners, the ground will be soon full of new roots. One thousand roots will increase to many thousand in two or three years, and then they can be dug up and will plant a large acreage.

Those who want a large acreage for hay or pasture should grow their own roots, just buying enough to give them a good start.

The hay is easy to cut and cure. Cut one day, it is ready to put in the barn the next day. It does not have to be crocked up in the field to cure, but it will go through a heat in the barn with no danger of spontaneous combustion. Unless it has water on it, it never moulds in the hay mow. If it gets rained on, it never drops its leaves or moulds in the field, but the water must be dried out of it before it is stored.

Kudzu is not a miracle, but it certainly is the best forage plant ever grown in America, and when you grow your own roots it costs less than alfalfa, and grows on a poor, acid soil where alfalfa, red or sweet clover will not grow. Even where alfalfa grows naturally and makes a fine crop, kudzu is far better for pasture, as stock never bloats on it, wet or dry, or at any stage of growth. The hay costs less than alfalfa, except in an arid climate, because you can cut it any time and it cures so quickly. Kudzu is described as a long-lived perennial legume. As a matter of fact, it lasts for generations. In New York and other places there are strong vigorous vines that were planted in 1877 and 1880.

The behaviour of kudzu vine under Rhodesian conditions is fully described in the *Rhodesia Agricultural Journal* of August, 1922, reprinted as Bulletin No. 429 of the Department of Agriculture, Salisbury.

Published under the Authority of the Minister of Agriculture and Lands.

A Handbook of Tobacco Diseases in Southern Rhodesia.

By J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.,
Government Plant Pathologist;
with Foreword by the Honourable the Minister of Agriculture and Lands, and Notes on Curing in relation to Disease, by D. D. Brown, Chief Tobacco Adviser.

Illustrated with 24 Photographs, 14 Figures and 6 Coloured Plates.

This handbook comprises some 80 pages of printed matter, and is principally an account, in popular terms, of the diseases of tobacco known to occur in the Colony. Although written primarily as a guide to the tobacco grower, yet there have been included technical descriptions of the organisms concerned with each disease; and, as an appendix, a discussion of the taxonomy and etiology of certain affections not fully described previously. A bibliography of 38 titles is also appended. The volume is of convenient pocket size (9½ ins. by 6 ins.) and bound in stiff paper covers.

A slight charge will have to be made to cover the cost of the coloured plates, so that it is proposed to sell the handbook at 3s. per copy; 3s. 6d. post free.

Enquiries to be addressed to the Director of Agriculture, P.O. Box 387, Salisbury.

Correspondence.

[*No responsibility is accepted by this Journal for the views expressed by correspondents.*]

The Editor,
Rhodesia Agricultural Journal.

Sir,

Screw Worm in Cattle.

In the article "Screw Worm in Cattle," which appeared in your Journal this month, it was stated, of the fly causing trouble, that: "Up to the present it has never been observed on farms." It may, therefore, be of interest to know that the flesh fly, *Sarcophaga,* which causes similar trouble in other parts of the world, occurs on this farm throughout most of the year. As there are no effective barriers to distribution, it probably occurs throughout Central Africa. Specimens collected on this farm last year were sent to the British Museum and identified as *Sarcophaga* by competent authority. There are several varieties or closely allied species of *Sarcophaga* in this district. In size and general appearance they are somewhat like the common blue bottle, but not quite so bloated. They are grey, silvery or nearly black, according to variety. In the commonest variety found here the upper surface of the abdomen is marked like a chessboard, with alternate squares of silver and dark grey, and the eyes are bright red in colour. The appearance is, therefore, characteristic, and the fly easily recognised.

The most important characteristic of *Sarcophaga,* however, is that they are viviporous. They lay maggots where most other flies lay eggs. Unlike the tsetse, which deposits one maggot every two or three weeks, *Sarcophaga* produces a large number. If a gravid female be gently squeezed, the maggots come out of the hinder end.

It is, of course, not yet certain that the screw worm which is causing the trouble in Rhodesia is the larva of

the flesh fly, *Sarcophaga*. The cattle here have not been attacked during the past five years, though the fly is constantly present. This is in accordance with the habits of *Sarcophaga* in other parts of the world. It seems to be an occasional or sporting habit of the fly to breed in living flesh, not a constant or normal habit. This would be associated with the fact that they are viviporous, for it is evident that a live maggot deposited on a sore would be able to burrow in at once, whereas an egg, taking a day or two to hatch, would be licked or rubbed off. An interesting parallel instance of a sporting parasite habit is the kea of New Zealand, a small parrot with an extraordinarily long and sharp beak. Soon after sheep were introduced, this bird acquired the habit of attacking them and feeding on the living flesh of the back.

I was very interested to read that the Director of Veterinary Research has been experimenting with a vaccine against screw worm. Though my knowledge of pathology is now out of date, it seems to me that the preparation of such a vaccine would be of considerable theoretical importance, opening up a wide field of application in other directions.

About thirty years ago Almroth Wright was preparing the first typhoid vaccine at Netley. So far as I can remember, it consisted of a pure culture of the typhoid bacillus, which was treated so as to render it innocuous. This was injected in two doses at intervals, with the effect that the resistance of the body was raised against any typhoid bacillus that might subsequently enter the body along with food or water.

The principle underlying this successful experiment was an application of that power of adaptation which is characteristic of all living things, whereby the body reacts against harmful influences so as to protect itself. A simple example of that principle is seen when we use a spade or oar. The friction of the implement at first produces blisters, and if it were not for the fact that the hand reacts under the harmful influence so as to produce thick, horny skin at the points of friction, the hand would wear away in ulceration.

Following on Wright's work various vaccines were prepared to cure various inflammatory diseases in man and beast due to the attacks of bacteria and other lowly organisms. All were on the principle that the resistance of the body was raised by injecting some extract or preparation of the harmful organism.

If a vaccine can be prepared from the body of the screw worm and injected into cattle so as to raise successfully the resistance against screw worm attack, there seems no reason why the same should not be done in the case of the tick, and a vaccine produced, not against tick-borne disease, but against the attack of the tick itself; so dipping might be done away with.

My knowledge of pathology is somewhat out of date, so that I would not venture an opinion as to the possibility of preparing such vaccines. It is to be hoped, however, that the Director of Veterinary Research will publish the method of preparing the vaccine against screw worm attack or let us know where the results are to be published.

If your entomological department would care to receive specimens of *Sarcophaga* caught in this district, I would be glad to send them some, similar to those that were identified last year as *Sarcophaga* by Major E. E. Austen.

I am, etc.,

R. E. Lloyd, M.B., D.Sc. (Lond.).

Kaombi Farm,
Serenje,
Northern Rhodesia,
21st March, 1931.

The screw worm vaccine is referred to in the annual report of the Director of Veterinary Research, published in this issue of the Rhodesia Agricultural Journal.

The following comments are by the Chief Entomologist. —Ed.

Flies of the genus *Sarcophaga* have been bred out from screw worm wounds, but only in very small numbers com-

pared with the true screw worm fly of this Colony, namely, *Chrysomyia bezziana*, Villen.

The latter is a species of blue bottle, which appears to be of true parasitic habits, and is not to be confused with other species of blue bottles, which breed in carrion and carcases. *C. bezziana* lays eggs in wounds; *Sarcophaga* produces living maggots. The role of *Sarcophaga* in reference to screw worm cases is not certain. It may possibly cause primary infestation, or its presence may be merely secondary to the attack of the true screw worm. In any case, experience to date is that it is of comparatively little importance.

Some species of *Sarcophagids* are of service to man in that they are parasitic on and destroy locusts. *Wohlfahrtia envittata* is a South African species which attacks all stages of the brown locust (*Locusta pardalina*), including the eggs.

Reviews.

MAIZE IN SOUTH AFRICA.

By A. R. Saunders.

(Central News Agency, Ltd. £1 net.)

Mr. Saunders, who is Senior Research Officer (Summer Cereals) in the Union Department of Agriculture, has by his publication, "Maize in South Africa," made a valuable addition to the text books published in the sub-continent on agricultural matters. All aspects of the maize plant, from its botanical origin to its commercial and economic uses, are very fully discussed.

We learn that maize is easily the most important crop in the Union, and production is concentrated in what is termed the maize triangle, wherein the rainfall varies from

20 to 30 inches per annum. The author emphasises his opinion that in many of the dryer areas a wider planting space than that usually adopted would materially benefit the crop. Experimental data are advanced in support of this contention, and it is stated that at Potchefstroom, in a three-year trial, a spacing of 3 feet by 2 feet has given an increase of half a bag an acre over a spacing of 3 feet by 18 inches, while the best yields have been obtained by check-row planting in hills 3 feet apart each way, with an average of two plants per hill.

Perhaps the most useful and interesting chapters in the book are those devoted respectively to (a) the botany of the maize plant, (b) maize diseases, (c) insect pests of maize, and (d) maize genetics, breeding and seed selection.

In regard to the latter, Mr. Saunders considers that while mass selection in the field and in the dump has had and will continue to have its distinct uses, particularly in so far as the practical farmer is concerned, yet as a method of scientific maize breeding it has very decided limitations. No one is likely to dispute this view, but the writer then proceeds very usefully to scrutinise and describe the more modern methods adopted by the plant breeder, including selection within selfed lines, double crosses and synthetic crosses.

Turning to the much vexed question of the advantages of maintaining a soil mulch, and repeated cultivations over and above those merely needed to rid the crop of weeds, interesting experimental results are quoted from the Dryland Experiment Station, Pietersburg, and the Glen School of Agriculture. At both centres the highest maize yields were obtained when cultivation commenced as early as possible and was continued until the silking stage of the crop. In each case also the lowest yields were given by the plots which received no cultivation and no weeding, and the next lowest where the weeds were cut off and their growth thus suppressed, but where no actual cultivation of the soil was practised.

Mr. Saunders' investigations into the control of witch weed (*Striga lutea*) have not yet reached finality, but the

pages dealing with this important subject deserve the careful study of all farmers interested in maize growing.

"Maize in South Africa" is a reference book, on the production of which both the author and the publishers are to be congratulated.

THE CULTURE OF THE ORANGE AND ALLIED FRUITS.

By H. Clarke Powell, Professor of Horticulture, University of Pretoria.

(Central News Agency, Ltd. 21s. net.)

This work covers 356 pages of particularly interesting and valuable information. Chapters are devoted to citrus varieties, nursery work, establishment of groves, bud selection and tree records, root-stocks, fertilisers and manures, cultural operations, packing, diseases and pests, etc. The author has also embodied chapters covering citrus culture in other countries, and some very interesting comparisons are made of methods employed in South Africa and California. Attention is also given to the matter of citrus by-products, and statistics are published showing the amounts and values of the commodities produced throughout the world. South Africa is unfortunately a non-producer of these, but there is no reason why this state of affairs should continue, and the economic utilisation of the material at the disposal of growers would certainly place the industry on a much sounder foundation.

Students and growers alike will find the book of the greatest value to them, and the author is to be complimented on a valuable addition to citrus literature.

Farming Calendar.

May.

BEE-KEEPING.

Last month under normal conditions should have seen the last honey flow of the season almost ready for robbing, for which purpose have the extractor overhauled, spare crates available, bee escape boards ready, honey jars and bottles ready for usage, and also have a few spare quilts on hand. Do not rob the bees of too much honey, remembering that sending them into winter quarters with a sufficiency of food means a strong issuing colony in the spring. Any new swarms that it may be decided to add to the apiary, feed well if necessary, to induce stimulative breeding while there is time, or if new young queens have replaced older ones also feea liberally this month in the proportion of one part of cane sugar to two of water; for the somewhat wild Rhodesian bee there is nothing like the Alexander feeder let in from the back. Keep all the spaces under hive stands clean, also inspect daily to see that white ants are not building up from the soil; if this is neglected much loss may follow. When seen, sprinkle diluted kerol from a watering can under the hive stand.

Granulation in the bottled honey can be prevented by first ripening the extracted honey in large tins covered with butter muslin for three or four days by exposure to the sun's rays. It should then be heated to a temperature of 150-160 degrees—nothing higher. As soon as this is reached withdraw the tins and bottle when cooling. The best way to obtain this heating is to place the tins in another receptacle of cold water and boil it up to the required heat, as heating it direct over a fire is very liable to burn the contents or to impair the delicate flavour of the natural honey.

CITRUS FRUITS.

The harvesting of the early ripening fruit should be commenced about the first week in May. Exporters should cure their Washington Navels for a longer period than usual; this will enable them to detect the thick skinned fruit easily. Where necessary, irrigation should be continued up to within ten days of harvesting. All ploughing and cultivation should be completed without delay.

CROPS.

Continue to cut and stook maize as it matures; make the stooks small to assist drying. Later in the season the stooks may be made larger. See that the stooks are secure and pick up plants lying on the ground. Continue to plough up land between stooks of maize. Give all maize harvested, whether husked or in the husk, a chance to dry out before riding to the dumps. Do not begin shelling if the ears are still damp. Do not use new grain bags for harvesting maize. Make the dumps of unhusked ears as small as possible; the smaller the dump the quicker the grain will dry out. Grain on the cobs dries extremely slowly, if at all, in dumps of large size. Do not mix unhusked ears from the stooks with dryer ears harvested later from the standing crop. Keep the dryer ears in a separate dump; shell, bag and stack such maize separately. When cutting maize for stooking, insist on the stalks being cut within 2 to 4 inches of ground level.

The plough, in Rhodesia, will not bury roots with stalks 8 to 12 inches high. A long stubble of stalks makes clearing of the ground for ploughing very tedious and expensive. If not already harvested, ground nuts should be lifted before the first frosts damage the hay. Finish transplanting onions from seed-beds. If plants are not flourishing after transplanting, give a light dressing of nitrate of soda—50 lbs. per acre. Repeat in a fortnight if needed. Sow most winter cereals on wet vleis or under irrigation early this month. Feed your sweet potato vines to stock; if frosts occur the vines will be killed. Dig and feed tubers from end of month onwards. Towards end of month harvest cattle pumpkins and melons and handle carefully; avoid bruising to prevent rotting. Place pumpkins and melons in a dry situation in the open and in a single layer. Supply plenty of roughage to cattle pens, kraals and stables to increase the manure supply. Collect and cart manure to lands for spreading. Do not attempt to plough in dry grass or quantities of maize refuse. The plough will not turn it under and it will not rot before next planting season. Burn such refuse and make a good job of the ploughing. If the weather seems set fair, commence brick-making. A small kiln of bricks always on hand is most useful. As labour permits, re-thatch buildings and outhouses in need of repair. Overhaul, grease and paint planters, drills and other implements not required again until next season, and store away under cover. Think about your fertiliser requirements for next season and place your orders. From now onwards the second ploughing of new land broken up earlier in the season should be pushed on with as opportunity offers.

DECIDUOUS FRUITS.

The pruning of early ripening peaches should be performed this month. All holes should be completed and kept in readiness for June planting. Ploughing or digging and cultivation should be completed without delay.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse (aphis) and Bagrada bug during May. For the former wash the plants frequently with a strong stream of cold water from a spray pump, or spray with soap and tobacco wash. Transplants may be dipped in the latter. Plants attacked by Bagrada bug may be sprayed with resin wash when the young bugs are exposed in the early morning.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling. Fumigate or spray for scale insects if necessary.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter. Collect fruit and destroy.

Tobacco.—Watch should be kept for the emergence of the adult wire-worm beetles. These should be poisoned with a bait consisting of maize bran moistened with a solution of 1 lb. arsenite of soda in 20 to 30 gallons of water. The bait should be rolled into small balls and scattered on the lands, one ball to each ten square yards. The bait should be covered with a few leaves and moistened as required. Chopped green stuff such as Napier fodder may also be used as a carrier for the poison, in which case molasses should be added at the rate of 1½ gallons to 10 gallons of the arsenite solution, or cheapest sugar at the rate of 10 lbs. per 10 gallons. The bait is best laid in the evening.

Fields of tobacco found to be heavily infested with gallworm should be thoroughly ploughed and cross-ploughed and laid down to an immune crop next season.

Cotton.—Continue trapping and destroying stainers. All dropped bolls should be collected and destroyed.

Maize.—Clean up storage sites, sidings and sheds against weevil.

Potatoes.—Late potatoes should be kept earthed up to prevent tuber moth from attacking the tubers.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out coniferous seedlings into tins or beds. Deciduous trees which are propagated by means of cuttings should be taken in hand. See that the fire lines are in order, and in the case of woods which have formed canopy, remove inflammable material below the edge trees.

POULTRY.

All cockerel chickens should be separated from the pullets, and every month gone over carefully, the poorer ones eliminated and only the very best kept. Those cockerels with the deep long bodies, short legs and round heads should be kept. Those with any inclination to long legs, knock knees, long heads or thin beak, lop-over combs, narrow bodies, or those lacking length and depth should be rigorously discarded. The chickens must not be allowed to become chilled, especially at night; on the other hand, they must not sleep in a hot stuffy atmosphere. On no account must they be overcrowded; this is fatal and is one of the many rocks on which poultry keepers come to grief.

The young stock must have all they can eat; to stint them is to ruin them for good and all. A bird that has been stunted never recovers. A good quality bone meal (lime phosphate) is absolutely necessary, as is also plenty of succulent green food, and no animal protein is better than thick separated milk for the health and growth of the chickens.

Those going in for ducks should hatch according to the numbers they have to supply for eating each week. Ducks must have all the food they will eat from the time they are hatched. A quick-growing duck should put on 1 lb. per week and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the large wing feathers commence to grow.

If the rains have stopped, turkeys can be hatched. See that the youngsters are kept warm, but also that they have plenty of fresh air. Never feed young turkeys on wet or moist food, but give dry mash, grain, plenty of onion tops or onions chopped small, and thick separated

milk. Keep them free from insect vermin; they will never thrive if they are infested with these.

Never allow the hen that has hatched the turkey eggs to run with the youngsters. Always confine her in a coop, through the slats of which the young turkeys can run in and out. The coop should be moved to fresh ground each day; nothing is worse for young turkeys than to be running on the same piece of ground for long at a time. Tainted ground is one of the chief causes of mortality among young turkeys.

STOCK.

Cattle.—Ranching cattle may still be expected to be in good condition. In most districts it will be wise to conserve hay, maize stover, ensilage and a supply of any other cheap feed as a provision against possible late rains in the spring, and to enable one to maintain the younger or very old stock should occasion arise. By the middle of this month dairy cattle will require more serious attention in the matter of feed. Grass should be cut for bedding and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies and care taken that they are clean and sufficient.

Sheep.—If the vleis have dried, sheep may be allowed into the lower lying veld. If the rams are put in now, lambs will arrive in October, which is usually a good month to arrange for. Those who favour winter lambs and have ewes lambing now will find a few handfuls of maize, together with chopped maize stalks or any other kind of available roughage or green stuff, a great help to the ewes in providing milk.

TOBACCO.

Curing should be completed as early in the month as possible to prevent loss from frost. The bales of tobacco should be examined and turned weekly until they are despatched from the farm. All bulks must be inspected regularly and turned if necessary. Tobacco seed should be shelled as soon as the seed pods are dry and the seed carefully labelled and stored in a dry place. The stumping, clearing and ploughing of new land, if operations have not already been commenced, should be no longer delayed. Land which has just produced a crop should be ploughed and harrowed as soon after the harvest as possible.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

During the major portion of this month the ordinary winter conditions prevail, viz., cloudless sunny days and cold nights. Frost may be normally expected at any time during the latter half of the month. There is often, however, a recrudescence of rain conditions during the early portion of the month, resulting in overcast days and light drizzling showers, the normal rainfall at many places, particularly in the southern and eastern portions of the country, amounting to over half an inch.

June.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold

weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less

watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Where it is necessary to move cattle to fresh pasturage, this should not be unduly delayed. Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eve should be kept on all watering places in order to prevent their being fouled or stopped up. Bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground nut cake or bean meal. Young calves are better in the pens on very cold mornings until the sun has gained some power, when they may run on short sweet veld for a few hours. The above remarks with regard to dipping and water supply apply equally to dairy as to ranching herds.

Sheep.—Sheep are best kept on the high veld for a while longer. If grass seeds are troublesome, a grazing area should be mown. If the rams were put into the flock in May, they should now be removed. Ewes with lambs will benefit by a few handfuls of mealies, and perhaps ensilage. They should be provided with shelter from cold winds.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

Notes from the "Gazette."

"Gazette" Date.	*Items.*
17.4.31.	Government Notice No. 192 prohibits the importation into Southern Rhodesia from any place overseas of unmanufactured broom corn derived from sorghum, whether green or dry, except under the authority of a special permit from the Minister of Agriculture and Lands, or his authorised substitute, the issue of which is subject to the condition that the straws must be detached, and the crowns from which they originate must be completely cut away or otherwise cut to shreds.
17.4.31.	Government Notice No. 252 sets out the conditions under which cattle may be imported into this Colony from Tati Concession.

Southern Rhodesia Veterinary Report.

February, 1931.

TRYPANOSOMIASIS.

The following mortality in cattle was reported: 2 cases at Gatooma, 21 in the Wankie district and 23 in Melsetter district.

HORSE-SICKNESS.

The following mortality was reported: Melsetter, 3; Wankie, 2; Belingwe, 1; Umzingwane, 1; Bulalima-Mangwe, 4; Salisbury, 1; Fort Victoria, 1.

CUTANEOUS MYIASIS (SCREW WORM) IN CATTLE.

This affliction has been very much in evidence in areas where the bont-legged tick is prevalent.

ANAPLASMOSIS AND PIROPLASMOSIS.

The mortality due to gall-sickness has been reported as exceptionally heavy, on account of the increased tick life this season, attributed to the relaxation of dipping last dry season.

SWEATING-SICKNESS IN CALVES.

This disease has been reported as being very prevalent.

STIFF-SICKNESS (THREE-DAY SICKNESS).

Reported to be prevalent in most districts.

BLUE TONGUE.

A few sheep have died from this disease.

IMPORTATIONS.

From the Union of South Africa: Bulls, 18; cow, 1; horses, 10; donkeys, 54; sheep, 2,576; goats, 296; pigs, 30.

EXPORTATIONS (CATTLE).

To the United Kingdom: 170. To the Union of South Africa: For local consumption, 127; for export overseas, 634. To Belgian Congo: Slaughter, 1,974; breeding, 62. To Northern Rhodesia: Slaughter, 546; breeding, 14.

EXPORTATIONS (MISCELLANEOUS).

To the Union of South Africa: Pigs, 37. To Belgian Congo: Pigs, 180. To Northern Rhodesia: Sheep, 279; goats, 28; pigs, 235. To Portuguese East Africa: Sheep, 35; goats, 25.

EXPORTATIONS IN COLD STORAGE.

Carcases: Beef, 256¾; veal, 6; sheep, 45; pigs, 6; livers, 251; tongues, 170; hearts, 431; brains, 131; tails, 95; tripes, 300; plucks, 15; cheeks, 60; kidneys, 46.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

MARCH, 1931.

Barometric Pressure was generally above normal.

Highs and Lows.—Six high pressure systems were in evidence during the month. The first moved round the south coast on the 1st to 3rd and was off Beira on the 5th. The second appeared on the 5th and 6th, but was very weak. The third was on the south coast from the 8th to 10th and then moved inland, being central in the Transvaal up to the

17th. This was reinforced by a high which appeared on the south coast on the 18th. The fifth and sixth highs appeared on the south coast on the 21st and 25th and were off Beira on the 24th and 28th. Lows were comparatively inactive. A weak low appeared on the south-west coast on the 6th and formed a trough to the north; this trough swung round the coast to Lourenco Marques on the 9th. A southerly low passed along the coast on the 23rd and 24th. On the 27th a low was on the south coast with a trough to the north. It moved inland on the 28th and remained as a fairly deep depression until the 31st.

Rain Periods.—Showers were fairly numerous on the 1st and 2nd, only isolated showers occurring on the 3rd. The second period commenced on the 9th with numerous showers, and cleared in the south on the 10th. A few showers were recorded from the 12th to the 14th. The third period was confined to the north, where showers were fairly general on the 15th and 16th. Scattered showers were recorded from the 18th to the 27th; no rain on the 28th. Showers were fairly general on the 29th and general on the 30th and 31st.

Rainfall.—The mean rainfall for March was 2.1 inches, as compared with a normal of 4.2 inches. The seasonal total is 21.6 inches, or 5.5 inches below normal.

	Rainfall to 31st March.	Normal to 31st March.	Per cent. of normal.
Zone A	20.7	24.0	86
Zone B	14.7	20.0	74
Zone C	23.0	29.7	77
Zone D	27.1	32.9	82
Zone E	23.8	31.0	77
Zone F	35.1	46.9	75

Hail.—Mr. Krige, of Mukwe River Ranch, Lomagundi, reports a fall of very large hailstones on the afternoon of the 31st. They are reported to have been of a dull grey colour, probably due to dust in the air.

MARCH, 1931.

Station.	Altitude	Pressure 8 a.m.	Temperature ° F.						Humidity, 8 a.m.		Precipitation.		
			Absolute.		Mean.			Diff. from Normal.	Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min.						
Bulawayo ...	4,440	870.0	92.0	54.0	83.9	59.6	71.7	...	61.7	65	1.23	-2.13	3
Gwelo	4,632	863.9	89.0	51.0	80.9	58.8	69.8	...	61.1	67	.80	-2.5	3
Riverbank ...	4,100	...	98.0	55.0	88.8	60.9	74.8	...	62.9	65	2.33	...	5
Essexvale ...	3,828	...	99.0	54.0	87.6	61.4	74.5	...	63.4	80	1.65	-1.9	4
Gwanda ...	3,235	...	98.0	55.0	85.1	61.1	73.1	...	63.8	56	1.64	-1.4	3
Mazunga ...	1,970	...	...	...	...	...	...	...	...	...	...	...	...
Nuanetsi ...	1,630	...	...	...	...	...	...	...	...	...	...	...	...
Between Rivers	3,970	...	94.0	55.0	86.0	60.6	73.3	...	65.7	68	.74	...	6
Enkeldoorn ...	4,720	...	90.0	50.0	81.8	57.5	69.6	...	62.3	70	2.08	-2.0	5
Gatooma ...	3,850	...	96.0	49.0	88.4	59.0	73.7	...	65.1	66	3.30	-1.0	8
Miami	4,090	...	87.0	57.0	80.9	69.1	71.4	...	64.7	81	5.22	- .3	10
Salisbury ...	4,865	856.1	89.0	51.0	81.6	59.1	70.0	...	61.9	68	.72	5.2	9
Sinoia Citrus ...	3,830	...	90.0	55.0	85.1	60.0	72.5	...	65.0	72	1.40	-2.8	3
Sipolilo... ...	3,900	...	87.0	57.0	82.6	62.1	72.3	...	65.3	72	1.65	-2.8	10
Juliasdale ...	6,070	5	80.3	50.0	72.6	54.3	63.4	...	60.0	84	2.51	-6.4	10
Mtoko	4,210	...	...	...	...	...	...	...	...	...	...	...	...
Shamva ...	3,170	...	...	...	...	...	...	...	...	...	...	...	...
Angus Ranch ...	2,300	...	99.0	60.0	86.4	66.7	76.5	...	67.6	75	1.6	-3.4	6
Craigendoran ...	3,000	...	94.0	54.0	85.2	61.5	73.2	...	67.7	75	2.44	-4.7	9
New Year's Gift	2,700	...	93.0	57.0	83.0	62.4	72.7	...	68.2	82	4.63	...	11
Nyamasanga ...	5,080	...	85.0	47.0	80.5	53.3	66.9	...	63.1	73	1.65	...	8
Riverdene North	3,700	...	95.0	51.0	82.0	58.0	70.0	...	63.6	80	.90	-4.4	12
Stapleford ...	5,450	...	79.0	46.0	71.0	54.0	62.5	...	59.6	84	6.32	-5.6	17
Umtali	3,677	894.0	88.0	55.0	80.1	61.1	70.6	...	65.1	80	2.95	-2.5	13
Victoria ...	3,570	897.4	92.0	52.0	79.9	58.8	69.3	...	63.6	72	1.95	-1.8	7
Melsetter ...	5,060	851.3	86.0	52.0	75.3	56.5	65.9	...	60.8	75	5.74	-1.9	17
Mount Silinda...	3,520	...	86.0	57.0	75.4	61.3	68.3	...	64.6	85	7.43	-4.3	18

Export of Cattle from Southern Rhodesia, 1931.

Month	Union		England.	Congo		N. Rhodesia.		Portuguese East Africa.		Total
	Slaughter		Slaughter							
	Union of S.A.	I.C.S. for overseas	On hoof	Slaughter	Breeding	Slaughter	Breeding	Slaughter	Breeding	
January ...	120	...	...	1,381	1,383	626	267	..	...	3,777
February ...	127	634	170	1,974	62	546	14	...	...	3,527
March ...	169	1,425	400	864	...	279	94	...	10	3,241
April ...										
May ...										
June ...										
July ...										
August ...										
September ...										
October ...										
November ...										
December ...										

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only. Outside Southern Rhodesia, 3d. per copy.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 581. Leguminous Crops for Stock and Soil Improvement in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 591. Maize Export Conference Proceedings.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 601. Maize for Export, by S. D. Timson.
No. 603. The Production of Maize in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 684. Warning to Maize Growers: Maize for Export.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.

No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

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Some of the Thornby Polled Hereford herd which achieved conspicuous successes at the recent Witwatersrand Show.

"Pisidove," foundation sire of the Thornby Polled Hereford herd and champion at the recent Witwatersrand Show.

THE RHODESIA

Agricultural Journal.

Issued by Authority of the Minister of Agriculture and Lands

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Editor - - *William E. Meade.*

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Rhodesian Cattle Successes at Witwatersrand Show.—Major Heydeman, of Thornby, Hartley, is to be heartily congratulated on the successes gained by his polled Hereford cattle at the recent Witwatersrand Show. The bull, "Pisidove," illustrated on the page opposite, was adjudged champion Hereford bull on the show. He was also awarded the Spencer Cup for the best specimen of the Hereford breed, and was placed first in the class for bulls three years and over. This fine animal was imported by Major Heydeman from the United States of America in April, 1927, and was one of the foundation sires of his herd. The bull was sold after the show for £160. Other awards secured by the herd were the Cooper Cup for the best three South African bred bulls, first in the class for bulls twelve to eighteen months and first in the class for yearling bulls, while polled "Twine," of Thornby, secured premier honours

in the class for heifers eighteen to twenty-four months. One of the bulls weighed 820 lbs. at 13 months 17 days, and another 731 lbs. at 10 months 15 days. There were eight animals shown from the Thornby herd, and altogether fourteen prizes were secured—two championships, five firsts, four seconds, two thirds and one fourth. Truly a fine performance.

Dairy Industry Control Bill.—This is one of the most important legislative enactments which the Colony has adopted for the improvement of the agricultural industry in general and the dairy industry in particular. The main object of the Bill is to impose a compulsory levy on all butter and cheese manufactured in the Colony, other than that required for domestic use. The funds thus obtained will be used for various purposes, chief among which will be the payment of a contribution to the Dairy Control Board in the Union of South Africa for the provision of a bounty on butter and cheese exported overseas. The monies so realised will also be utilised generally to assist the development and betterment of the dairy industry. The provisions of the Bill become operative on a date to be announced in the *Government Gazette.*

It is the intention, at an early date, to publish an article in this journal describing in some detail the main provisions of the Bill and their effect on the dairy industry.

Marketing of Hides and Skins.—Before the High Commissioner (Hon. J. W. Downie) left Southern Rhodesia, he was approached, especially by farmers residing in the south-eastern part of the Colony, and asked to ascertain what prospects existed for the marketing of zebra hides, rhino hides and baboon skins.

Enquiries have been made, and the information obtained is as follows:—

Zebra Hides.—No demand at present; first class quality hides might fetch 5d. per lb. and seconds 4d. per lb.

Rhino Hides.—These are mostly used for the manufacture of glue. There has been a quiet request at about 1d. per lb., but it is not thought it would pay to transport rhino hides to the London market at the present time.

Baboon Skins.—There is no demand whatever for these and they have no value on the London market.

Tobacco Pest Suppression Bill.—This measure which was passed by the Legislature at the recent session gives power to an accredited officer of the Government to inspect warehouses for the purpose of ensuring that no insect-infested tobacco is exported overseas.

Briefly, the Bill prohibits the export of unmanufactured tobacco from a warehouse which is not licensed in terms of the Act. Authority for the granting of a licence is vested in the Minister of Agriculture and Lands, and he may suspend the licence of any warehouse which is infested with the tobacco pest *Ephestia elutella*, tobacco weevil, or any other pest. It is the duty of the owner of a licensed warehouse, who knows or has reason to believe that the warehouse or its contents are infested with any tobacco pest, immediately to notify the Minister to that effect and thereupon to cease to export tobacco therefrom. Authority is given the Minister to order the destruction of any tobacco which, in his opinion, is so infested with a tobacco pest as not to justify cleansing by fumigation or otherwise. Provision is made for appeal from the Minister's decision to a board appointed by the Governor. No responsibility rests with the Minister, the Government or its servants for any damage or loss sustained by reason of the carrying out of the provisions of the Act.

The maximum penalty for contravention of any of the provisions of the Act is £200.

Matopo School of Agriculture and Experiment Station.—The prospectus of this school has now been issued and can be obtained from the Principal or the Director of Agri-

culture at Salisbury. The functions and activities of the institution include:—

(1) A two-years' Diploma Course for students, which is designed to give a sound, up-to-date education in farming and a thorough training in agricultural practice and science.

(2) Special and short vacation courses, which may be attended by farmers and their wives and daughters and others interested in any of the various branches of farming.

(3) The Demonstration Farm, which will be always accessible to farmers who wish to profit by the investigational work in live stock and crop raising that will be carried on, and from which an annual supply of pure seed and pedigree stock will be available for sale to farmers.

(4) An extension service, which provides for technical officers visiting individual farmers, attending farmers' meetings, judging at shows, and generally advising on all matters pertaining to animal and field husbandry.

(5) Research work facilities to provide for the investigation of problems that are of importance in overcoming local difficulties, increasing productivity, and generally adding to the profit-earning possibilities of farming.

The fees are £60 per annum, payable quarterly in advance. These fees include board, laundry, tuition and ordinary medical attention.

Situated on the main road from Bulawayo to World's View, about 20 miles from the former place, in the historic and imposing environment of the Matopo Hills, the school has scenic and natural advantages seldom met with in an institution of this nature. Adjoining the school is the experimental farm comprising some 11,500 acres of the original Westacre Creek Farm and representative of a large area of the Colony, including red and vlei soils and granite sandy soils. About 200 acres of land are below the irrigation furrow of the Matopos Dam, and all the more important summer and winter crops of the Colony can be grown successfully.

The scheme for the establishment of the Matopo School of Agriculture was approved by the Government during October, 1929, when it was decided to start operations from the beginning of 1930. After several delays, in June, 1930,

the junior school and the experimental farm were merged into a single institution under the control of a principal, jointly under the direction of the Department of Education and the Department of Agriculture. In December, 1930, the junior school was closed and the direction of the whole institution was vested in the Department of Agriculture.

As stated by the Minister of Agriculture and Lands (Hon. R. J. Fletcher) in an introductory note to the prospectus, the Matopo School of Agriculture and Experimental Station may now be said to be fairly launched on its career of, it is hoped, usefulness and assistance to farmers of the Colony.

The "Cattle Levy Act, 1931."—This Act, to which reference was made in the April issue of the Journal, is an emergency measure, providing a levy to take the place of the cattle bounty that lapsed at the end of last year.

The Act, as finally approved by the Legislature, provides for a levy not exceeding 2s. 6d. per head in respect of all cattle slaughtered by any person who slaughters more than five head per annum for sale, barter or consumption. The levy on calves slaughtered is not to exceed 6d. per head. A levy not exceeding 2s. 6d. per head is also payable in respect of all cattle exported from the Colony, other than cattle exported overseas, whether such cattle be exported on the hoof or as chilled or frozen meat.

A provision is made in section 4 of the Act for an Advisory Board, consisting of five members, to be appointed by the Governor-in-Council, one, who shall be chairman of the Board, being nominated by the Minister of Agriculture and Lands, and the remainder by cattle breeders representative of the four cattle areas, comprising the northern, midlands, eastern and south-western districts of the Colony. The manner of appointment of these members and the extent of the areas will be prescribed by regulations to be issued later. It is further provided that for the first twelve months the members of the Board, with the exception of the chairman, shall be cattle breeders nominated by agricultural societies approved by the Minister. These nominations also have to be approved by the Minister.

The proceeds of the levy are to be devoted to—

(a) payment of subsidies on the export overseas of meat or live cattle when deemed to be necessary and desirable in the public interest;

(b) payment of the expenses of the aforesaid Advisory Board;

(c) such other purposes to assist the development and betterment of the cattle industry as the Board may, with the approval of the Minister, determine.

Clause 6 of the Act gives power to the Governor to make regulations prescribing the manner in which the amount of the levy is to be fixed, the amount of the levy, the manner in and purposes for which it shall be collected, and the time at and period for which it shall be paid, and generally for the better carrying out of the objects and purposes of the Act.

The Act is to be operative for the period of two years from the date of its commencement, whereupon, unless re-enacted, it will lapse. The Governor may, however, by Proclamation in the *Gazette*, suspend its operation at any time during the period mentioned.

The Tobacco Outlook in the United States.—According to the "Agricultural Outlook for 1931," issued by the Department of Agriculture of the United States of America, the general outlook for tobacco in that country is less favourable than it was a year ago; the domestic demand has weakened and the foreign demand is only regarded as fair. The Department suggests that some decrease in acreage is desirable. "Stocks of flue-cured and Burley leaf are becoming burdensome, and a reduction in the acreage under these types appears to be specially desirable." Tobacco acreage in the United States in 1930 constituted a record, being about three per cent. greater than that of the previous year. The record acreage of 1930 (2,110,300) was largely brought about by increased plantings of Burley and flue-cured tobacco, which together represented about

77 per cent. of the total acreage harvested. Although the average yield per acre was the lowest for over 30 years—due to drought—the total 1930 production is estimated at 1,510,308,000 lbs., which is only slightly less than that of 1929.

The total exports of leaf tobacco from the United States during the 1930 calendar year, most of which were from the 1929 crop, show an increase of 2.4 per cent. over 1929, but declining exports in the late months of 1930 suggest the probability of reduced foreign takings of 1930 tobacco.

The position is summed up as follows: "The outlook for exports of American tobaccos of 1931 production in general is probably no less favourable than the situation now existing as to the 1930 crop. Flue-cured tobacco continues in good demand in Great Britain, and appears little affected by competition from colonial-grown leaf. Because of a decrease in exports to China and other countries, however, the total exports of flue-cured tobacco from August to December were 36,052,000 lbs., or 14 per cent. less in 1930 than in 1929. In China the low silver exchange is one of the factors which is affecting trade adversely, but the well-maintained activity in cigarette manufacture and improved political stability may lead to some improvement a year hence.

"Continental Europe, although still suffering from industrial depression and unemployment, is taking tobacco in larger volume, especially American fire-cured types. To some extent this probably represents stocking up on low-priced goods in anticipation of a higher German tariff on tobacco. European demand for flue-cured tobacco appears to have been well maintained in 1930. Cigarette consumption is increasing there as elsewhere, although 'Oriental' tobaccos are much more important in cigarette manufacture than is American."

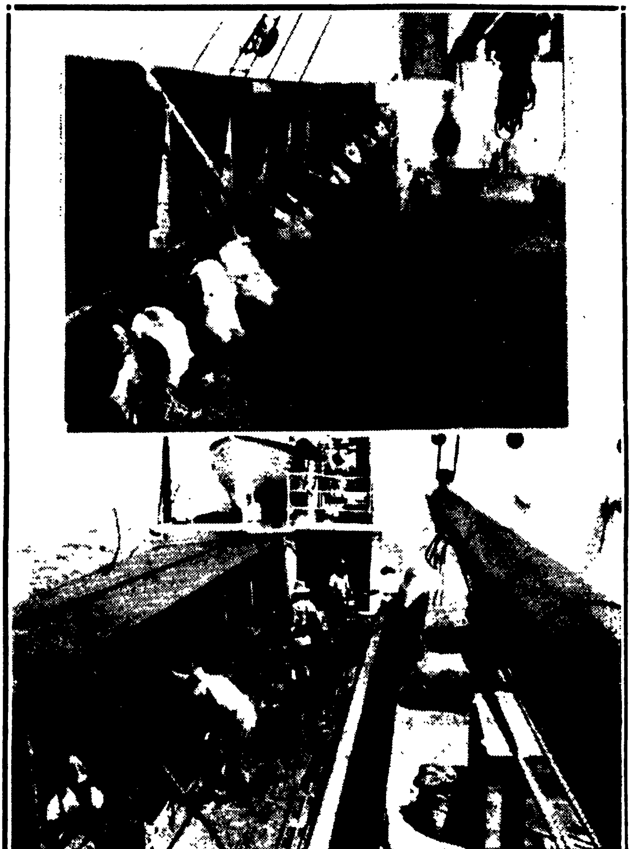
The Australian Tobacco Market.—According to *Tobacco*, the American trade journal, which, incidentally, is remarkably well informed about the tobacco industry in the British Dominions and Colonies, including Southern Rhodesia, Australia has an import trade in leaf tobacco

averaging about 22,000,000 lbs. a year, 98 per cent. of which is supplied by the United States. There is also a fairly important trade in tobacco products in which the United States, the United Kingdom and the Netherlands share honours. The imports of leaf tobacco in 1928-29 amounted to 21,138,000 lbs.; cigarettes, 1,020,000 lbs.; smoking tobacco, 244,000 lbs.; chewing tobacco 827,000 lbs.; and cigars, 109,000 lbs. Although the imports of leaf tobacco in 1929 show a decline when compared with the previous year, the trend of the trade has generally been upward since the Great War.

Australia has for some time been endeavouring to reduce her imports of tobacco by growing her own requirements, but the total production in 1928-29 was only 1,838,592 lbs., the great bulk of which was grown in the States of New South Wales and Victoria. For the past three years an Australian Tobacco Investigation Committee has been carrying out investigational work in connection with the tobacco industry in Australia. One of the important tobacco companies and the Commonwealth Government entered into an agreement whereby the sum of £90,000 was to be spent to carry out tests to determine the capabilities of Australia to produce her own requirements.

The terms of the agreement were that over a first period of three years, which expired on 30th June, 1930, the company would contribute a sum of £20,000 for investigation and field testing, and that the Commonwealth and State Government would provide £10,000. If, at the expiration of this period the work had progressed satisfactorily enough to warrant further expenditure, the company was to contribute an additional £30,000 and the Government £30,000 for expenditure over a further period. The company also agreed to buy for the three seasons—1927, 1928 and 1929—tobacco crops properly graded of lemon-coloured tobacco at 2s. 6d. a pound, and offered a bonus of 6d. per pound for the purpose of stimulating the production of the first two varieties.

During the past year a select committee, which was appointed to enquire into and report upon the position of the tobacco-growing industry, made the following recommendation: "That the Federal investigation work hitherto



Rhodesian cattle en route to England per S.S. *Clan Malcolm*, March, 1931. These cattle were shipped on behalf of the London and Rhodesian Mining and Land Co., Ltd.

carried out with financial assistance from the tobacco company should be carried on by a Federal tobacco department, presided over by a Federal director, who should be responsible only to a Minister. The director should be in charge of all research and experimental work, and all matters relating to the welfare of the tobacco growers. The company, and any other manufacturing interest, should be given every opportunity to make special monetary contributions to the funds used by the department in research and experimental work."

The future working of the Tobacco Investigation Committee is still under consideration by the Federal Cabinet.

Foot and Mouth Disease.—The position in regard to the disease at the time of writing (18th May) is that infection is spreading very slowly. In the last issue of this journal it was stated that the extent of the infection was as follows: The main road from Beitbridge to the farm Seed, ten miles from Enkeldoorn; to the west, that the limit of infection was section 8 of Liebig's Ranch, which adjoins Nuanetsi Ranch at the Nuanetsi River; to the east, that the furthest known infection was at Shashashas, 58 miles east of Beitbridge. In the report by the Chief Veterinary Surgeon, from which we quote, it was also stated that five sections of Nuanetsi Ranch were infected.

Since then, the disease has extended from Enkeldoorn to Gwelo and occurs on various farms within a radius of ten or twelve miles of Gwelo. This extension is clearly attributable to a movement of cattle prior to the closing of the district. It has also spread slowly to the north of the outbreak on Seed Farm, and is found as far as the farm Gilfinnan, some twenty miles north-east. On the west of Fort Victoria there is a minor outbreak on the Fort Victoria-Shabani road on the Lundi river, and a further outbreak is reported on Zeederberg's Block in the vicinity of Shabani. The position in the Chibi district is obscure; parts of the district are undoubtedly infected, and until more precise information is available it is assumed, for purposes of discussion with neighbouring States, that the whole district,

with the exception of the Matibi Reserve No. 2 and the land south and east of that reserve is to be regarded as an infected area.

Negotiations are now in progress with neighbouring States with a view to obtaining such modification of the embargo as will permit the export under a system of export permits of all agricultural produce, including frozen meat, as may be desired from areas not within twenty-five miles from any known infection. These negotiations have led to the release of certified butter for export to the Union, to Northern Rhodesia and the Congo, with the provision that the cream used for the manufacture of such butter must be pasteurised; and it is hoped that other relaxations will be obtained at an early date. The export of hides, certified as dry salted prior to 30th September, 1930, has been permitted to the United Kingdom *via* Beira.

A report by District Veterinary Surgeon King as to the character of the disease is printed in this number of the journal, and indicates the very mild type of the disease, but it must be accepted that the disease, although of the mildest type, is nevertheless foot and mouth disease. It is therefore most advisable that owners of stock near an infected farm should take every precaution to see that their cattle are kept as far as possible from infected herds and never allowed to graze on or near the same pastures.

Some of the Problems in Marketing Southern Rhodesia Tobacco.

AN OUTLINE.

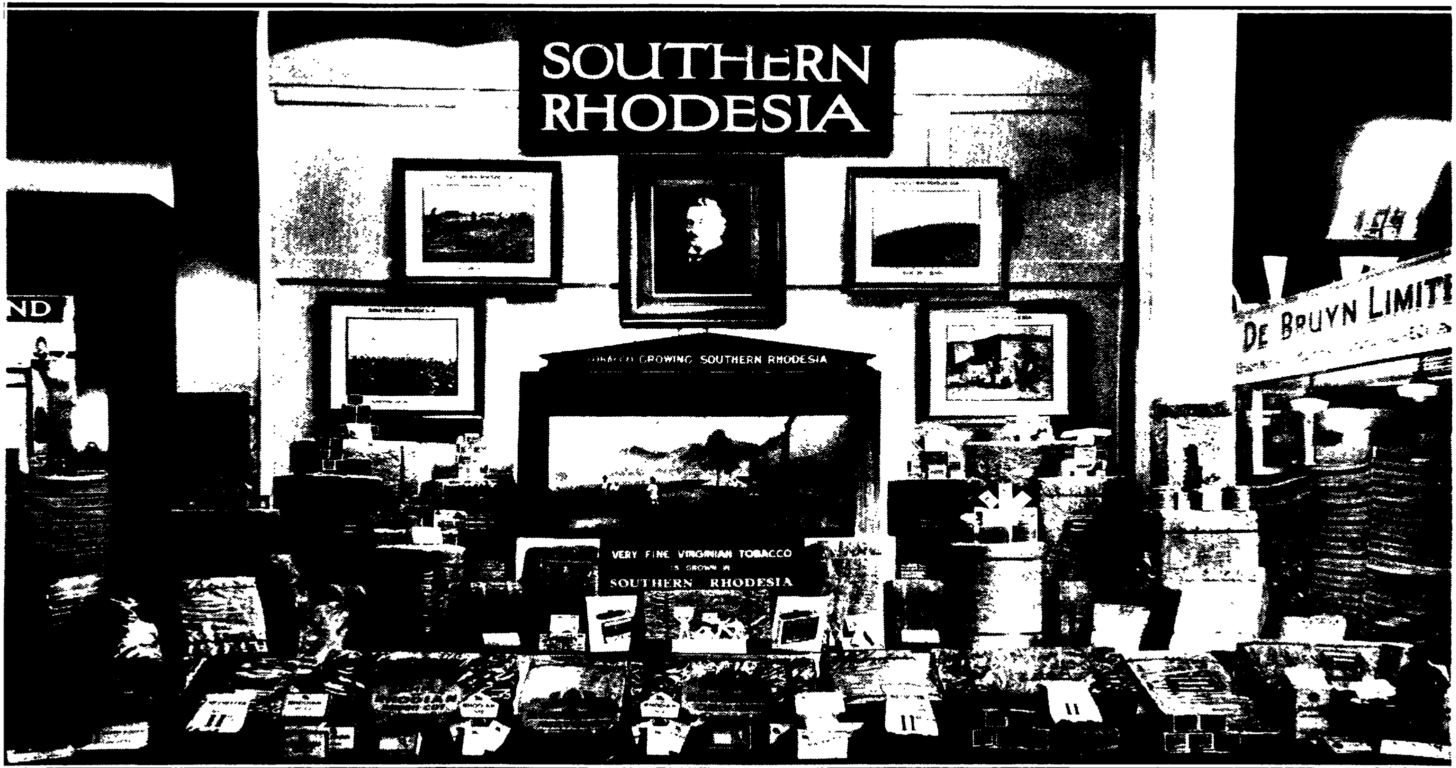
By D. D. Brown, Chief Tobacco and Cotton Expert.

It will be remembered that Mr. D. D. Brown, the Chief Tobacco Expert, proceeded to England towards the end of last year for the purpose of investigating certain technical and economic problems concerning the marketing of Southern Rhodesian tobacco in the United Kingdom. As a result of this investigation much valuable information was gained by Mr. Brown, and is the subject of a special report to the Government. In the present article Mr. Brown has outlined briefly for the benefit of growers in this Colony some of the impressions gained by him during his stay in England. It will be noted that although he considers the outlook to be brighter, Mr. Brown urges growers to study market requirements and to adjust their production accordingly. This is a point of great importance, and we commend it to the very careful attention of all concerned. It should be mentioned that the visit of the Chief Tobacco Expert to England was carried out under the ægis of the Empire Marketing Board, which is doing such excellent work in the United Kingdom for the primary producer of the Dominions and Colonies. —Ed.

The problems confronting the tobacco industry of this Colony are numerous and complex. The hopes of tobacco producers are now centred in the United Kingdom, for it is realised that Great Britain possesses the greatest potentialities in so far as the marketing of Southern Rhodesia tobacco is concerned. The main difficulty in the past has been the slow rate of progress made in increasing the consumption of our tobacco on that market. The rapid expansion in production of the crop in Southern Rhodesia has not tended to improve the situation, though it is readily conceded that curtailment in output effected over the past two or three seasons has served to minimise the disastrous effects of over-stocking the market beyond the capacity of existing marketing facilities. The existence of surplus stocks, especially if considerable enough to cause deflation in market values, is bound to affect adversely the prices offered for subsequent consignments of tobacco which may arrive whilst the surplus stocks are manufactured at too high a level. It is apparent, therefore, that curtailment in production is but one factor in remedying the present situation. The regulating of supplies would eventually restore the equilibrium of the market if the operation was accomplished with the co-operation and assistance of the brokers and manufacturers primarily interested in Southern Rhodesia tobacco.

In order to expedite the restoration of the market, however, the regulation of supplies must necessarily be supplemented by endeavours to dispose of all surplus stocks and clear the market within a reasonable time. The rate of clearance should accelerate in proportion to the diminishment in the surplus and according to the quality of the tobacco. Clearances are almost bound to be retarded whilst the surplus stocks are preponderently large, but as the quantity reaches a reasonable level, then it might naturally be expected that the movement of tobacco would become freer. Low grade and undesirable tobacco cannot be expected to sell freely under any circumstances, and even if sold at all, the price offered is too low to warrant further shipments of similar grades to this market.

The consumption of Southern Rhodesia tobacco in the United Kingdom is increasing steadily. In the year 1926,



Southern Rhodesia exhibit at the Plymouth and West of England Bakers', Grocers' and Allied Traders' Exhibition at Plymouth, 11th to 21st March, 1931.

it amounted to 1,098,000 lbs., and in the year 1930, to 5,322,000 lbs.—an increase of roughly 4,250,000 lbs. Competition is becoming keener, and if the above-mentioned rate of increased consumption is to be maintained or expanded, it is essential that producers should maintain the highest possible standard of quality in their product. A close and intelligent study of market requirements presents another important factor in the development of our sales in the United Kingdom.

Manufacturers' requirements, in regard to types and grades, are already being specially studied and catered for through the medium of their agents resident in this Colony, and production is being influenced accordingly. This principle must be extended to include all tobacco destined for shipment to the United Kingdom. Many manufacturers using our tobacco have no resident buyer or agent, though their requirements are just as specific as any firm which may be represented out here. A closer study of their special needs is clearly indicated, and if put into practice would result in more rapid and substantial development of our market. Permanent results are not likely to be achieved by any artificial means or temporary expedients. The desired progress can only be made through co-operative efforts of the producers and the manufacturers, and this can only be accomplished by mutual arrangement. It is absolutely essential that the goodwill of the tobacco trade be retained and augmented, if possible.

The adoption of any measures which would alienate the sympathies of buyers of Southern Rhodesia tobacco would have the direct effect of stimulating the demand for the tobaccos with which we are now in keen competition. It must be fully realised that Empire tobaccos, as a whole, have become established in Great Britain only through the agency of Imperial preference. The foothold thus gained still requires to be consolidated, and eventually Empire tobaccos must be rendered impervious to any tariff modifications.

Price levels have become extremely keen, and, since the introduction of the rebate on import duty, operate on highly competitive lines, a fact which, perhaps, is not generally recognised by Empire tobacco growers. The

foreign tobacco producers have, therefore, been forced to sell their product at lower prices in order to minimise, to some extent, the preference in favour of Empire tobaccos. The cost of production has also been reduced to a minimum, and every effort is being concentrated towards improvement in the quality of the tobacco produced.

The policy of producing tobacco at a minimum cost compatible with quality has also been adopted by tobacco producers within the British Empire. It is imperative, therefore, that similar measures be adopted in Southern Rhodesia, otherwise it would be impossible to meet competition successfully. Much has already been accomplished in this direction, but there still remains room for further improvement in the quality of our product and reduction in production costs.

There is every indication that the industry in Southern Rhodesia is slowly recovering from the set-back it experienced in the last few years, and the prospects are somewhat brighter than they have been for some time. It would be a fatal mistake, however, to assume that our tobacco industry has fully recovered from its recent difficulties. The closest attention to market requirements and careful handling of the situation are still essential. The turning point has been reached, but we are not yet clear of our difficulties. Although the outlook appears to be brighter, there is nothing to warrant any uncontrolled optimism. Tobacco growers are, therefore, warned against any rapid or extensive increase in acreage during the forthcoming season. A gradual increase in production according to market requirements and greater concentration on quality and the type of tobacco in demand is recommended as being a much safer and sounder policy.

The demand for Southern Rhodesia tobacco cannot become normal until the surplus stocks are reduced to within reasonable limits. When once this has been accomplished, then it may be expected that the demand will become more stable and that the industry will progress accordingly. Any appreciable addition to the existing surplus of Southern Rhodesia leaf in the United Kingdom would be disastrous, and recovery would be very much more difficult than has

hitherto been the case. One of the main factors retarding the sales of our product and also serving to reduce the average price per lb. is the high percentage of low grade tobacco which has been shipped from this Colony to Great Britain during recent years. A reduction in the percentage of low grade leaf in future shipments would enhance the demand for Southern Rhodesia tobacco and materially assist in maintaining a fair average price for the better grades.

Whilst a few manufacturers have expressed their preference for tobacco shipped in bales, many others would prefer tobacco shipped in casks or wooden boxes, preferably casks. This is another matter which might well receive the consideration of those exporting tobacco to the United Kingdom.

The elimination of unsuitable varieties of tobacco, and the adoption of others which meet the requirements of manufacturers, will be an important factor in the building up of our overseas market. To do this requires careful and systematic experimentation and seed selection. This is a matter which is receiving special attention on the recently established Tobacco Research Station at Marandellas, and until these investigations are further advanced and reliable data obtained, growers would be well advised carefully to select seed from disease-free and true-to-type plants of the variety best adapted to their particular soil and climatic conditions. The production of large quantities of seed, usually accomplished at the expense of quality and uniformity, is to be deprecated.

Tobacco seed should be fully developed on the plant, and in order to secure this development the seed heads must be well trimmed and thinned out until each seed plant carries a maximum of 60 seed capsules. The exercising of the utmost care in cultural, curing and handling operations will also yield favourable results.

Although the general standard of grading has improved of late years, it may be observed that the grading of Southern Rhodesia tobacco is still capable of improvement. The entire contents of each container should be uniform in grade and quality; mixed grading retards sales and reduces the value of the tobacco. The full confidence of tobacco

buyers in the United Kingdom cannot be secured unless they can be assured of unvarying uniformity in the grading of our product. Such confidence is essential to facilitate the sales where it is customary for tobacco to be bought on sample. The foregoing remarks are not offered in any spirit of adverse criticism, but are made in the hope that they will be of assistance to tobacco growers in effecting further improvement in their product. Permanent improvement in the tobacco industry can only be established through well directed and sustained efforts of the growers themselves, and not through any artificial expedients.

Very useful, though by no means exhaustive, information was secured by the writer during the relatively limited period available for the investigations conducted in the United Kingdom. It must not be presumed, therefore, that finality has been reached in regard to a complete study of overseas requirements. The necessity for following up the work already accomplished and for the pursuance of further and more exhaustive investigations still remains.

NOTICE.

Handbook of Tobacco Diseases.

The publication of this book to which reference was made in the last issue of the Journal, has been delayed a little longer than was expected and copies will not be ready for distribution for possibly another four or five weeks. Orders, which should be addressed to the Director of Agriculture, Salisbury, are being taken and will be executed as soon as supplies of the book are received.

The Law of Supply and Demand.

No. 2.

By J. R. McLoughlin, M.Sc. (Economics),
Economic Adviser.

It is perhaps asking a lot to expect the layman to read and digest an article of this nature, but the writer feels convinced that the matter of such discussions is perhaps more frightening than difficult. However, in view of the numerous references one sees from day to day to the law of supply and demand, and the great reliance placed on it by the various schools of thought, it is necessary for the farmer to grasp the real meaning of it. Moreover, it will assist in the better understanding of some of the articles to follow.

The origin of the law of supply and demand was not due to the necessity of framing economic policies. It arose as the most tenable explanation of what factors enter into the determining of value. It was impossible to get very far in economics without understanding the nature of the thing called value. Observations on an ordinary market gave rise to the theory that value arose out of the bargaining of buyers and sellers; and thence we derived the theory that the true value of an article was that brought about by supply and demand. It is most essential to grasp this point, however, namely, that the value so brought about is merely for a point in time, meaning that the market quotation on a given date is the true value on that date only.

And now we pass from a stationary conception of value into a world of rapidly changing events. We find many influences affecting both supply and demand, and one of the principal of these is the regard that is paid to the immediate future. In this new life-like condition we often find the same demand and the same supply giving rise to

different values. We thus immediately have an acid test for the theory. But this is only the beginning of a more practical understanding of the law of supply and demand.

One of the first things we notice in practical life is that the values of a particular article fluctuate not only from year to year, but from week to week, and even from day to day. Now, since it is the law of supply and demand which brings about the values in each instance, which of these values is the true one? For three years the average price of maize might be, say, 10s. per bag; for a few of those weeks it was 6s. and for some of the days 4s. Since every one of these values was brought about by supply and demand, which of them is the true one? It is obvious that the law of supply and demand at any given time does not give us an idea of what value we can base our long-time business programme on. The law is misunderstood. It is the long-time operation of that law that determines a "normal value" and a tendency or direction which that normal value is likely to take. If maize to-day fell to 2s. below cost of production, but was sure next week to rise to 2s. above cost of production, would we decide this week not to produce it any more? The question is obviously absurd, and is best answered by another question. If maize this year was 2s. below cost of production, but was sure next year to be 2s. above cost of production, would we decide not to produce any more? We probably would not, providing we were sure of next year's price. The point to be illustrated is this, namely, that even where supply and demand determines an unpayable level this year or this week, we would not dream of giving up our business as being against the law of supply and demand if we knew that the future value was likely to be profitable. The whole of our policy in producing an article will, therefore, depend on our estimate of its likely future value.

The foregoing illustrations serve to show that it is not the value determined by the law of supply and demand for a week, a month or a year, but the "normal value" over a fairly long period that can be the only possible basis of determining the question as to the payability or otherwise in the production of an article.

If the future indicates that an article will return to its normal value there is nothing uneconomic about selling at a loss temporarily so as to maintain the value of our farms and keep them occupied. Industrial plants often have to sell at a loss for long periods to prevent their capital value being lost. But it is undoubtedly unsound for any industry to depend on subsidies for such purposes from any source other than of its own making—that is, its own reserves. Of course, we must count the cost in each instance.

This is by no means a plea to prove that any sort of production must be bolstered up. The idea is to explain the practical meaning of the law of supply and demand. The explanation is carried a point further in the ensuing paragraph.

Let us now look at the question from a different angle. There are periods when the value of a commodity is very high, for instance, tobacco during the late tobacco boom. We might very well at the time say that it is the true value, because it has been brought about by supply and demand. But will anyone argue that it is the normal value or the one we base our policy on, and therefore justify basing land values on the high spasmodic value? Those who do so invariably find themselves, after a while, loaded with land that is obviously not worth what they paid for it, and they will be paying interest on a mythical value that does not exist after their own capital has been absorbed.

The foregoing arguments are calculated to show that it is just as wrong to base our business policy on a subnormal value of a commodity as it is to do so on an abnormal value, even though both these low and high levels are at the time determined by the much-quoted law of supply and demand.

The writer is anxious that readers get a good grasp of the idea involved in "normal value," because much of the economist's work is concerned with pointing it out for the purpose of guiding our policy in the production of an article. The idea of normal value can be simply illustrated in the following manner: Imagine a piece of wire stretched across two poles as a clothes line. It has numerous laundry pegs attached to it, and they are of various lengths; some

hang downwards towards the ground and some stand on end pointing to the sky. If one took a long piece of string and connected up all the ends of these clips we would get an irregular zig-zag line going above and below the wire. The zig-zag line would represent the fluctuations in value and the wire would represent the "normal value." Now this wire may be slanting upward or downward—that is the trend or tendency of the values, except that in practice the wire (*i.e.*, the normal value) is not a straight line but a curve. Still, the idea is exactly the same.

In conclusion, it should be once more made clear that the ordinary conception of supply and demand is a very theoretical one. The modern economist examines very largely the influences which affect each of them, and so he is able to come to a conclusion which indicates the long-time effect of the working of the forces of supply and demand.

The functions of an Economics Branch include the constant forecasting of future tendencies in value, and if it can succeed in its task, there can be no question as to the very real value of its work.

Foot-and-Mouth Disease.

The following report has been submitted by District Veterinary Surgeon B. L. King to the Chief Veterinary Surgeon.

The following details of the course of the disease have been gathered from my observations of the outbreaks on Seed Farm in the Charter district, and particularly in the outbreak on the farms Nos. 9 and 10, Watershed, Gwelo. In the latter instance the disease was expected, and the herd therefore kept under close supervision, and frequent inspections were made prior to and since the detection of the disease there.

Period of Incubation.—Seven to twelve days; these periods are arrived at from the date of possible contact with

infection to the first evidence of the symptoms, but it is probable that fever exists for about 24 to 48 hours earlier.

Description of the Disease and Symptoms.—For descriptive purposes it is considered advisable to classify the disease into three divisions:—

(a) Lesions on the mouth only.
(b) Lesions in feet only.
(c) Lesions in feet and mouth.

(a) *Lesions on the Mouth only.*—The first symptom noticeable is strings of clear coloured saliva running from the mouth, an examination of which at this period fails to reveal any lesions.

After 24 to 48 hours the saliva becomes profuse and is converted into a foam, due to the continual smacking of the lips and rolling of the tongue.

At this stage an examination of the mouth will show vesicles or eruptions either on the tongue or the dental pad; these vary from the size of a sixpence to a florin, and are usually circular in shape on the tongue and oblong on the dental pad. The vesicular period is of very short duration; the vesicles soon collapse and a greyish white deposit is found, which, on being removed, reveals a bright red patch.

The animal at this stage grazes spasmodically, but rarely lies down. In about three or four days from the initial symptoms the flow of saliva rapidly decreases, the animal feeds freely and to all outward appearances is normal, but the mouth lesions, although considerably reduced in size, are still present. In about 10 days from the onset, these symptoms are scarcely discernible, and recovery takes place with little loss of condition.

This division comprises scarcely 10 per cent. in an infected herd.

(b) *Lesions in Feet only.*—This condition is introduced by general stiffness and a disinclination on the part of the animal to move about. This stage lasts from two to three days, during which period there are no noticeable lesions anywhere, and the condition is almost indistinguishable from stiff-sickness or Ephemeral fever. Soon afterwards an uneasiness is noticed and the animal moves the legs alternatively with an action indicating a desire to remove some

offending object. A manual examination now will show tenderness in the vicinity of the coronet and heels, which is followed at varying intervals with lesions in the shape of vesicles, soreness and ulceration, accompanied by pronounced lameness. The course of the disease at this stage depends on the degree of the symptoms manifested. In mild cases, which number about 80 per cent. of the infected herd, recovery takes place in about 10 days; in other cases the lesions may be prolonged and observations in the present herds would indicate that even in the most severe case, a period of 21 to 24 days from the onset of symptoms should show complete recovery.

Other factors, such as the animals being travelled any great distance during the period of infection, or complications with screw maggot (a few cases occurred in the Charter district) tend to prolong the condition.

In the mild cases recovery takes place with little loss in condition.

(c) *Lesions in both Feet and Mouth.*—It will be gathered from the description given above that the disease runs it course in from 10 to 24 days.

Milch Cattle.—The first symptom noticed is a sudden diminution in the milk yield, accompanied by a rise in temperature. It is stated that the yield returns practically to normal in about 10 days.

Mortality.—The mortality to date is approximately 1-3 per cent., but it should be noted that grazing and water facilities at the present moment are abundant.

Spread of Infection.—Infection in a herd spreads rapidly. In the case of Watershed 9 and 10, the whole herd of 300 animals was practically involved four days after the first case was observed.

It might be interesting to record that practically all the outbreaks in the Charter and Gwelo districts can be attributed to movement of infected animals or where cattle have been grazed or passed over infected tracks. This would appear to indicate that suspected vectors, apart from bovines, are playing very little part in the dissemination of the disease.

Salisbury Agricultural Experiment Station.

ANNUAL REPORT, 1929-30.
(*Continued.*)

By H. C. ARNOLD, Manager.

(*Published with the approval of the Chief, Division of Plant Industry.*)

THE RELATIVE VALUE OF CERTAIN GREEN-MANURE CROPS.

Green-manuring having become a regular practice with a large number of Rhodesian farmers, these trials were commenced in response to numerous enquiries as to the relative merits of the various crops which are commonly used for the purpose. Leguminous crops are usually preferred because they are able to utilise the free nitrogen of the air, and thus to enrich the soil with nitrogen to a greater extent than non-leguminous crops. However, it was thought possible that owing to their greater bulk, non-legumes might provide a larger amount of humus, and for that reason prove more beneficial. Sunn hemp, velvet beans, dolichos beans and cowpeas are the usual legumes employed for green manuring, while sunflowers and "Niger" are suitable non-legumes. Cowpeas, however, were not included in these trials, since owing to the stem-maggot, the crop is an unreliable one at this station. Sunn hemp has become deservedly popular during the last few years, chiefly because of its suitability to a wide range of soils, its rapid growth, which smothers weeds, and the ease with which it can be ploughed under. Sunflower continues to be a popular green

manure crop, but "Niger" is now seldom used on account of the small size of the seed making it difficult to sow and owing to its slow early growth.

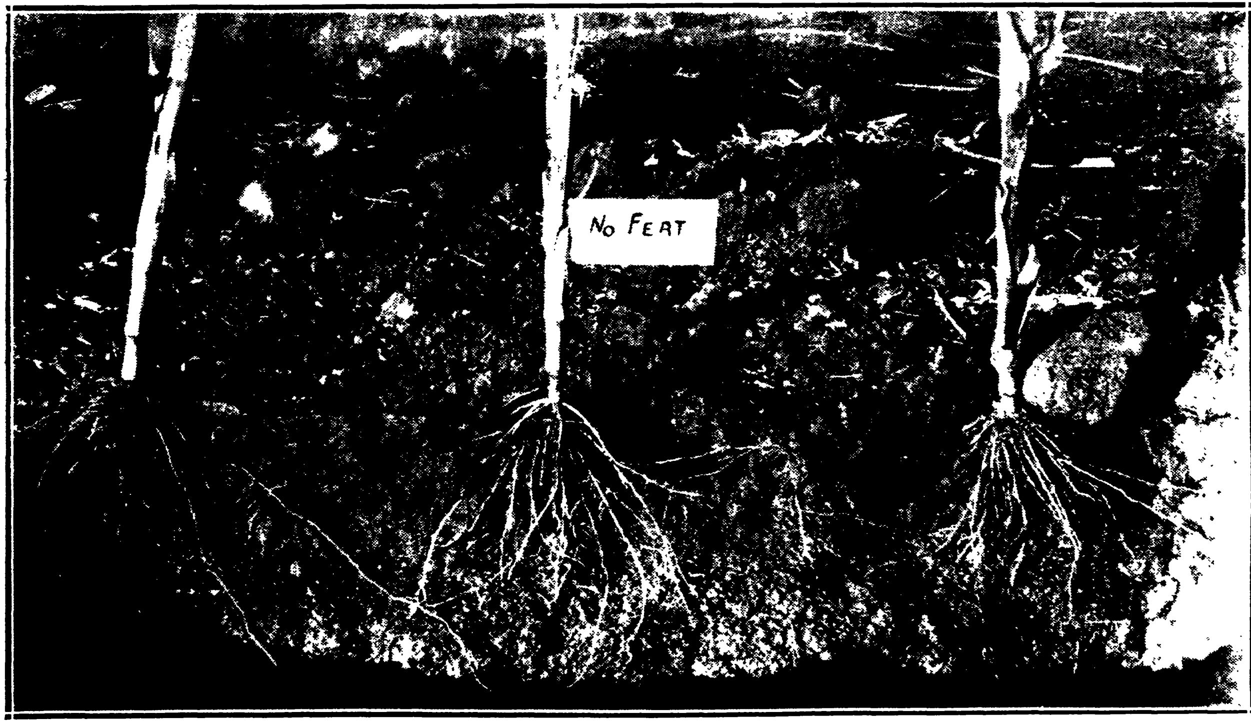
Green Manuring Trials.

Maize Yields in Bags per Acre.

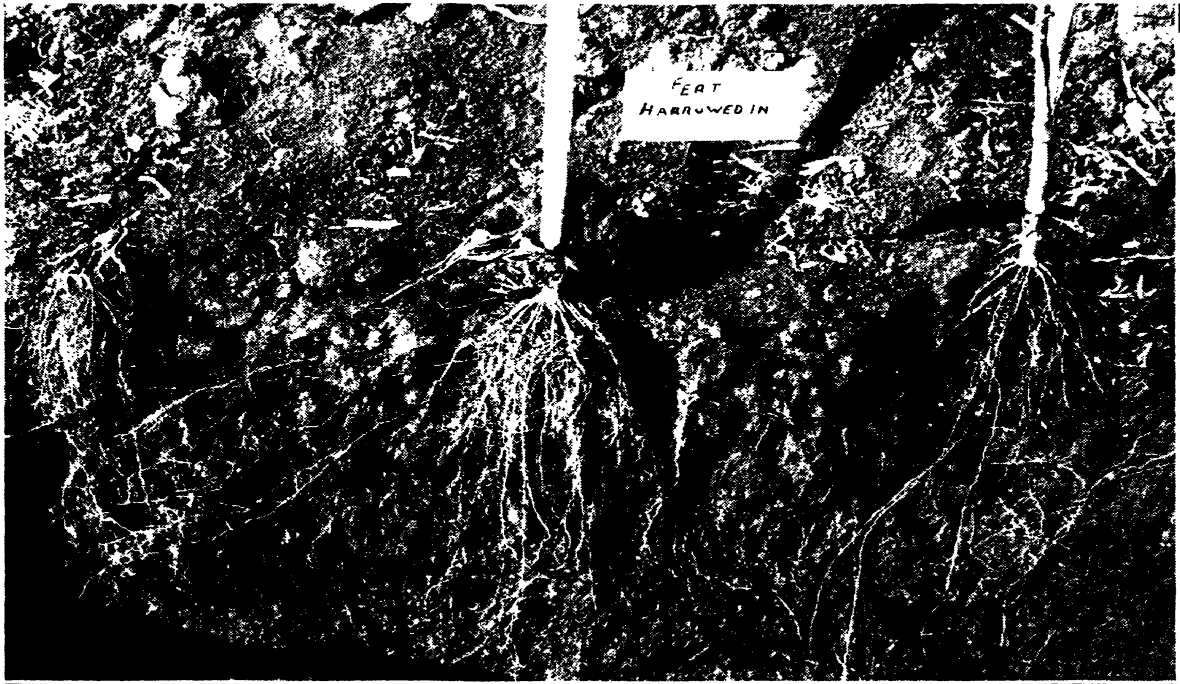
Kind of green-manure crop.	1st series. Average of two crops, 1925-27	2nd series. Average of four crops, 1926-30	3rd series. One crop, 1927-28	4th series. Average of two crops, 1928-30	Average of nine crops.
Sunn hemp ...	16.78	17.05	14.96	16.29	16.29
Velvet bean ...	15.26	17.80	12.34	15.43	.16.10
Dolichos bean ...	13.80	16.87	18.40	14.93	16.22
Niger Seed ...	...	16.08	...	...	...
Sunflower ...	...	...	...	13.77	...

The figures given in the last column are averages for 18 plots, and as there are such small differences between each, they would seem to show that all the leguminous crops are equally effective as soil improvers. The question of which is the best for any particular farm must be decided after consideration of its suitability to local conditions and other characteristics. Since the commencement of these experiments Sunn hemp has consistently gained in popularity to the exclusion of the other legumes, in spite of the fact that owing to low yields and expense of reaping and threshing the seed costs considerably more than that of the other crops. Experiments are being undertaken with a view to finding means of increasing the seed production of Sunn hemp, as by that means the cost of green manuring could be somewhat lessened.

In these trials the legumes have consistently given decidedly better results than the non-legumes. In the fourth series the average yield after green manuring with legumes was 1.78 bags per acre per annum more than that on the plots which were manured with sunflowers. Hence the legumes have returned an increase of 3.56 bags per acre more than the non-legume, which indicates that a leguminous crop is likely to prove the more profitable, even though the initial cost of the seed may be somewhat greater.



Root development of maize to which no fertiliser was given. Development was smaller, with a marked absence of the finer root hairs.



When fertiliser was broadcasted and harrowed in there was a vigorous growth of roots, but these were generally located nearer the surface than where the fertiliser was applied at a deeper level.

Farmers who need roughage for stock feed sometimes ask whether it is not more profitable to use a crop for hay or silage than to plough it under for green manure.

In the second series of these trials the plots were divided, and a half of each plot was reaped for seed, after which the stalks and leaves were removed, so that only the roots and stubble remained to enrich the soil. The average yields of duplicate plots are tabulated below.

Yields of Maize in Bags per Acre.

	Green-manure crop.							
	Velvet bean.		Sunn hemp.		Dolichos bean.		Niger oil.	
	Ploughed under.	Reaped.	Ploughed under.	Reaped.	Ploughed under.	Reaped.	Ploughed under.	Reaped.
1926-27 ...	23.08	20.52	21.52	20.96	22.44	20.40	20.88	18.56
1927-28 ...	19.84	16.40	19.20	16.88	19.08	16.16	18.08	14.56
1928-29 ...	13 76	11.32	13.02	12.20	11.80	10.64	12.16	10.92
1929-30 ...	14.54	.74	14.48	14.20	14.14	12.66	13.20	11.96
Total four years	71.22	59.98	68.22	64.24	67.46	59.86	64.32	56.00
Difference in favour of ploughing whole crop under	+11.24		+3.98		+7.60		+8.32	

Average +7.79

It appears therefore that over a period of four years an average increase of nearly eight bags per acre has been obtained from the plots on which the whole crop was ploughed under as against ploughing under the roots only. The material ploughed under in the case of the velvet and dolichos beans would be equal to about 1-1½ tons of hay per acre. Whether it is more profitable to use the crop for hay or as green manure will depend on the circumstances. If it is fed to stock in the form of hay or silage it will usually be converted into a marketable form quicker than if it is utilised as green manure. Owners of live stock may prefer to use it in

that way, and when this is done the fertility of the land will be maintained by returning the manure to the fields.

The reason for the difference between reaping and ploughing in, in the case of the Sunn hemp, being less marked is not fully understood, but it may well be due to the very much thicker sowing and the far greater number of plants per acre, which with their nodule-bearing fibrous roots add large quantities of vegetable matter to the soil, thus enriching it to such an extent that the effect of the removal of top growth is less marked.

FERTILISER AND GREEN MANURE TRIALS.

There are now few, if any, farmers in the maize areas who doubt the value of artificial fertilisers and green manure as means for increasing the yields of their crops, but doubt still exists as to whether it is more profitable to apply fertiliser to a green manure crop which is to be followed by maize, or to apply the fertiliser direct to the maize crop after ploughing under an unfertilised green manure crop. Advocates of the former method assume that a considerably larger quantity of vegetable matter will be available for ploughing under, and that because of this additional humus, and possibly nitrogen, the following maize crops will be increased more than if the fertiliser is withheld for application direct to the maize.

The plots on which these experiments are being carried out had previously been used for fertiliser trials and cropped to maize. Some of these plots were of average fertility after having received moderate dressings of fertiliser, but the producing power of other plots had been much reduced by constant cropping without the addition of manure of any kind. Thus the two methods of applying fertiliser are being tried out on land of moderate fertility as well as on land of low fertility. On half of these plots raw phosphate rock was used, and on the other half a mixture of one-third bone meal and two-thirds superphosphate; in each case the fertiliser was applied at the rate of 200 lbs. per acre.

In the tabulation below, the four plots which gave the lowest yields during the season preceding the commencement of these trials are grouped separately from the remaining

four higher yielding plots in each class, in order that comparison of the effects of treatments may be facilitated.

Yields of Maize in Bags per Acre.

	Fertiliser applied to green-manure crop.			Fertiliser applied direct to maize (after green manure).		
	Plot No.	Season 1927-28. Before trials began.	Season 1929-30	Plot No.	Season 1927-28. Before trials began.	Season 1929-30.
All plots of low fertility	5 b 1	.52	13.44	6 b 1	1.04	14.00
	8 a 2	2.08	18.40	5 a 1	4.08	15.60
	6 a 2	4.20	18.96	8 b 2	4.16	17.32
	5 b 2	4.32	17.60	10 a 2	5.32	16.72
	Totals	11.12	68.40		14.60	63.64
	Averages	2.78	17.10		3.65	15.91
	Difference		+14.32			+12.26
All plots of moderate fertility	6 a 1	4.72	17.40	8 b 1	5.84	16.72
	8 a 1	7.32	17.92	5 a 2	6.60	18.12
	10 b 1	7.64	17.00	6 b 2	6.72	18.52
	10 b 2	8.28	20.72	10 a 1	9.36	18.16
	Totals	27.96	73.04		28.52	71.52
	Averages	6.99	18.26		7.13	17.88
	Difference		+11.27			+10.75

This tabulation indicates that in the case of the low fertility plots there is a difference of 2.06 bags per acre in favour of applying the fertiliser to the green manure crop, but that on the plots which were of moderate fertility when the trials began, a gain of only half a bag per acre is recorded. The results appear to confirm what may be regarded as a common sense view of the position, namely, that if the

fertility of the land has been maintained at a moderately high level it is less economic to apply the fertiliser to the green manure crop than direct to the maize crop; but on the other hand, where previous cropping has reduced the producing power of the land to a very low level, then the application of fertiliser to the green manure crop will be found economically justifiable, particularly if a slow-acting fertiliser such as raw phosphate rock is being used.

The greatly increased yields obtained by this combined green manure phosphate treatment testify to its efficiency in a very striking manner.

THE RELATIVE EFFECT OF RAW PHOSPHATE ROCK AND BONE AND SUPERPHOSPHATE.

In the season 1928-29 when the fertiliser was applied to the green manure crop, four plots were dressed with raw phosphate rock and another four with a mixture of one-third bone meal and two-thirds superphosphate, while a further eight plots were reserved for similar treatment the following season. In view of the different treatments given in previous years and the resulting performances of these plots, however, it was found impossible to divide them equally between the two kinds of fertiliser without giving a bias in favour of one or the other, and it was decided to apply each kind of fertiliser on separate halves of all the plots. In this way each of the fertilisers was applied direct to the maize on eight sixteenth-acre plots instead of four one-eighth-acre plots as was the case when the fertiliser was applied to the green manure crop in the previous season. The returns from the two fertilisers are tabulated below. To facilitate comparison of their relative effect, the plot yields for the season preceding the commencement of these trials are included.

Yields of Maize in Bags per Acre.

	Fertilisers applied to green-manure crop.				Fertiliser applied to maize.			
	Yield before trials began, 1927-28	Raw phosphate rock, 1929-30	Yield before trials began, 1927-28	Bone and supers, 1929-30	Yield before trials began, 1927-28	Raw phosphate rock, 1929-30	Bone and supers, 1929-30	
					4.08	17.20	14.00	
	0.52	13.44	4.72	17.40	4.16	17.84	16.80	
	2.08	18.40	4.32	17.60	5.04	13.44	14.56	
	4.20	18.96	7.32	17.92	5.32	16.88	16.56	
	8.28	20.72	7.64	17.00	5.84	16.64	16.80	
Totals ...	15.08	71.52	24.00	69.92	6.60	16.88	19.36	
Averages	3.77	17.88	6.00	17.48	6.72	19.04	18.00	
Difference		+ 14.11		+ 11.48	9.36	18.08	18.24	
					47.12	136.00	134.32	Totals
					5.89	17.00	16.79	Averages
						+ 11.11	+ 10.90	Difference

Where the fertiliser was applied to the green manure crops, the average yield was raised from 3.77 bags per acre to 17.88 bags per acre on the plots which received the raw rock phosphates. Thus an increase of 14.11 bags was obtained on those plots against an increase of 11.48 bags per acre from the plots which received bone and superphosphate, or a difference of 2.63 bags in favour of rock phosphate. It has been pointed out above that the plots which were low yielders in 1927-28 responded more freely to the treatment than the moderate yielders, and as a larger number of low yielding plots were included in the group which received rock phosphate, this may account to some extent for the greater response indicated.

When the fertilisers were applied direct to the maize on separate halves of the original plots, the returns show equal response to both kinds of fertiliser, and although the raw phosphate is less soluble than the superphosphate, it gave, in this instance, equally beneficial results during the first

season after application. These plots will continue to be cropped again without further treatment, after which more complete information regarding the relative merits of the two fertilisers and the methods of using them should be available.

METHOD OF APPLICATION OF FERTILISER TRIALS.

These investigations were undertaken at the request of the Maize Association with the object of ascertaining whether the manner in which fertiliser is applied to the land is likely to affect the yield of the maize crop. The fertilisers were applied in four different ways, namely:—

(1) Broadcast during winter and ploughed in.

(2) Broadcast shortly before planting time and harrowed in.

(3) In drills at the time of sowing the seed.

(4) In holes, by hand, in check rows, with the seed at the time of planting.

Fertiliser was applied at the rate of 200 lbs. per acre. In the season 1928-29, a mixture composed of one-third bone and two-thirds superphosphate was used, but during the season under review Rodia Double Complete Fertiliser was applied instead. The plots used under the various methods last year were allotted to the same methods again this year, to simulate the practice of farmers who may have adopted one or other of the methods.

The season before the trials began, records were obtained of the yields of the various plots to ascertain their relative crop producing power irrespective of fertiliser treatment. The area was then divided into five blocks of four plots each, and one plot in each block was assigned to each method in such a manner, that the total yields of each group of plots equalled one another as nearly as possible. By arranging the plots in this way, the different methods of applying the fertiliser were allotted to high yielding and low yielding plots, and the inequalities of inherent soil fertility which so often interfere with experimental results were overcome as far as circumstances would permit.

In the following tabulation, the yields of the individual plots are grouped according to the method of application employed. Those for the season preceding the commencement of the trials are included for comparison, and in the two columns on the right are shown the differences between

the yields during that season and those for the two following seasons :—

Yields in lbs. per one-twelfth Acre Plot.

Method of applying fertiliser.	Block No.	1927-28 Season before trials began.	1928-29 Bone and super.	1929-30 Double complete maize.	Difference between yields of season 1927-28 and 1928-29	Difference between yields of season 1927-28 and 1929-30
Harrowed in	1	168	136	163	- 32	- 5
	2	266	180	239	- 86	- 27
	3	190	113	199	- 77	+ 9
	4	267	128	234	- 139	- 33
	5	313	205	236	- 108	- 77
		1,204	762	1,071	- 442	- 133
Ploughed in	1	153	125	189	- 28	+ 36
	2	243	141	232	- 102	- 11
	3	234	130	241	- 104	+ 7
	4	228	177	270	- 51	+ 42
	5	336	275	256	- 61	- 80
		1,194	848	1,188	- 346	- 6
In holes with seed	1	193	128	184	- 65	- 9
	2	237	171	228	- 66	- 9
	3	240	127	228	- 113	- 12
	4	228	182	237	- 46	+ 9
	5	315	245	231	- 70	- 84
		1,213	853	1,108	- 360	- 105
Drilled with seed	1	141	105	181	- 36	+ 40
	2	262	152	223	- 110	- 39
	3	211	124	210	- 87	- 1
	4	287	166	258	- 21	- 29
	5	301	262	205	- 39	- 96
		1,202	809	1,077	- 393	- 125

The results indicate that in the season 1928-29 in which the rainfall was fairly evenly distributed the method of application of the fertiliser made very little difference to the ultimate yield, though it may be noted that the least favourable results were obtained where the fertiliser was broadcasted on the surface and harrowed in. In the following season, however, when the rainfall was scanty in February and March, the yields from the plots on which the fertiliser was ploughed-in were appreciably greater than those of the other plots on which the fertiliser was placed nearer the surface. It appears likely, therefore, that the incidence of the rainfall is a controlling factor, and the experiments must be continued for a number of years before it will be possible to draw definite conclusions.

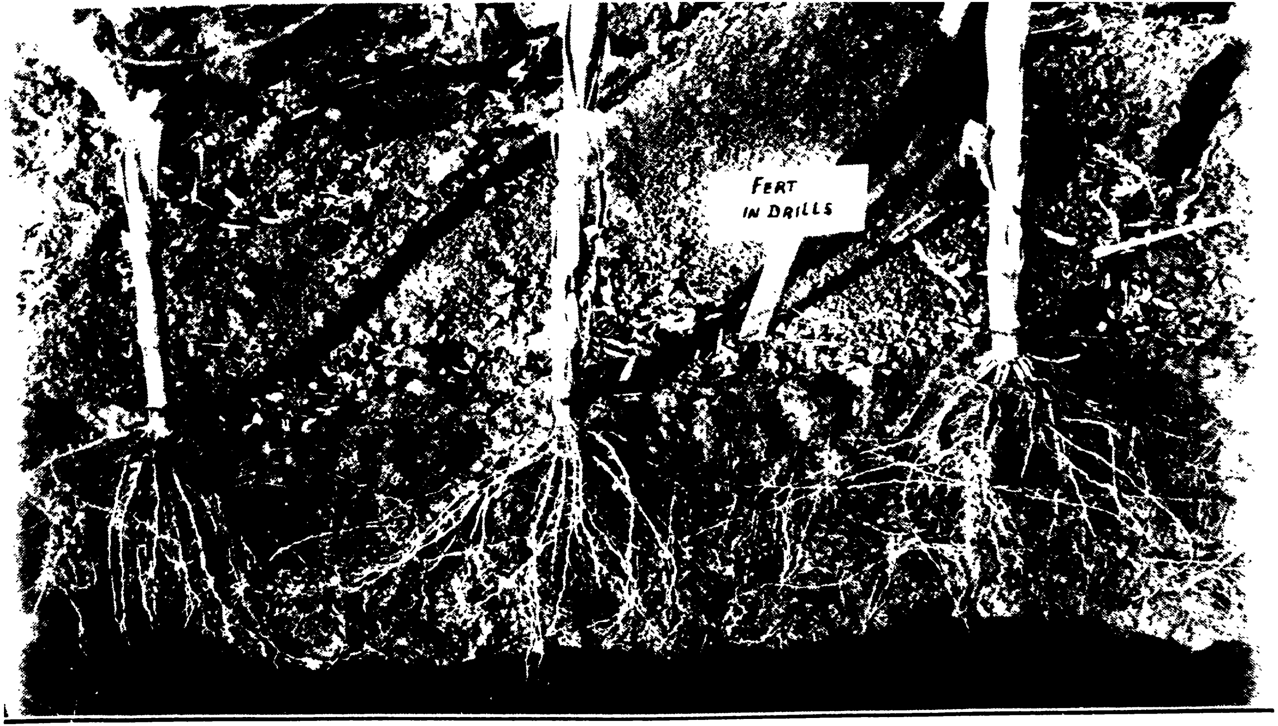
MAIZE MANURED WITH FARMYARD MANURE *VERSUS* FARMYARD MANURE SUPPLEMENTED BY PHOSPHATE FERTILISERS.

The object of these experiments is to determine whether it is more economical to use farmyard manure by itself or to use it in conjunction with phosphate fertilisers in the production of maize.

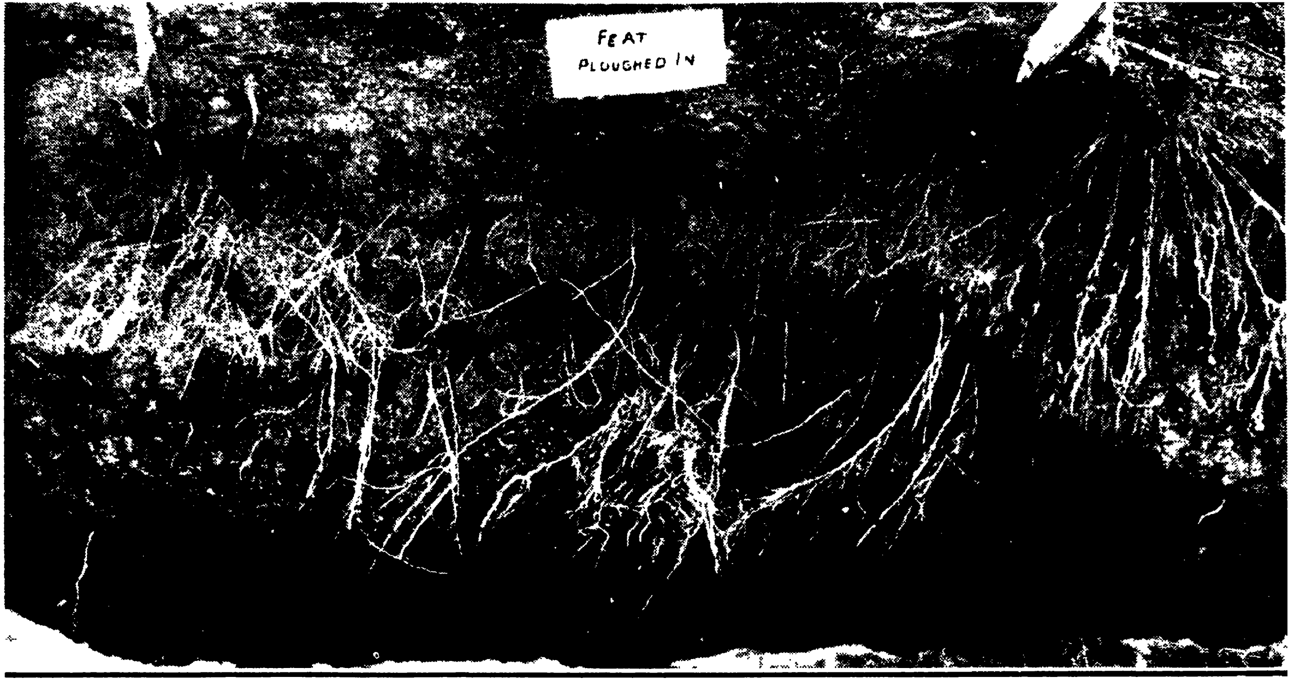
The manure used consisted mainly of the unconsumed parts of maize-stover which had been fed to cattle, and tramped in the kraal by them during the previous winter and early part of summer. When well soaked by the summer rains and partially decayed, it was piled into a heap and left to mellow. In August it was spread on the land at the rate of eight tons per acre and ploughed in.

The phosphatic fertilisers (a) one part bone meal and two parts superphosphate (b) superphosphate (19 per cent. P_2O_5) were each applied on duplicate plots at the rate of 300 lbs. per acre, while two plots received only farm manure.

The investigation was commenced in 1926-27 when manure and fertilisers were applied to the respective plots. The treatment was repeated in 1928-29. The averages of duplicate plots are given in the following table:—



There was little noticeable difference in root development where fertiliser was applied in the drills and in the holes below hand-planted maize.



Where the fertiliser had been ploughed in root penetration was generally deeper and the maize roots appeared larger and stronger.

Yields of Maize in Bags per Acre.

Treatment.	1926-27	1927-28	1928-29	1929-30	Totals, 4 years.	Increase due to phosphatic fertiliser.
Farmyard manure plus bone and supers ...	18.52	9.47	13.70	13.23	54.92	3.82
Farmyard manure plus superphosphate ...	17.53	11.59	13.23	12.61	54.96	3.86
Farmyard manure only	16.56	9.18	13.16	12.20	51.10	...

The returns indicate that, as a result of applying 300 lbs. of phosphatic fertiliser per acre an increase of approximately only four bags of maize or one bag per year, has been obtained. Since the response to fertilisers was so small, it would appear that the manure contained enough phosphate to supply the needs of a fairly heavy maize crop, and that the addition of phosphate in the form of artificial fertiliser was not of sufficient benefit to justify the expense incurred. The response to added fertiliser phosphate was much less marked during the second period of this experiment than the first, which suggests that the humus-content of this land may be the limiting factor rather than the phosphate-content.

MAIZE ON UNPLOUGHED TOBACCO RIDGES *VERSUS* PLOUGHED TOBACCO LAND.

These trials were conducted at the request of a well known tobacco grower with the object of finding out whether an increased crop of maize commensurate with the extra expense incurred, would be obtained by ploughing and preparing in the usual way, land which has previously carried a tobacco crop, or whether it is likely to be more economical to plant the maize by hand in the unploughed fertilised hills previously occupied by the tobacco plants.

In principle this experiment is similar to the "Method of Application of Fertiliser" trials reported on above, as it is designed to ascertain whether the maize plant can make better use of the residue of the tobacco fertiliser while it is concentrated in the hill, or whether equally beneficial use

can be made of it after it has been distributed over a wider area in the ploughing and other operations necessary to the preparation of the seed bed.

The land used for these trials had received eight tons of farmyard manure broadcast, and 300 lbs. per acre of a mixture of one-third bone meal and two-thirds superphosphate applied in the hills under the tobacco plants. On the unploughed ridges the maize seed was planted in the same spot that the tobacco plants had occupied during the previous season.

Yields of Maize in Bags per Acre.

Season.	Ploughed.	Unploughed.
1928-29	19.40	17.90
1929-30	19.76	16.22
Averages of 5 plots	19.69	16.56

On every one of the five pairs of plots in this experiment, ploughing increased the yield, the average increase being 3.13 bags per acre or nearly 20 per acre above that of the unploughed plots.

Whether the value of the increased yield would exceed the cost of ploughing and other operations involved, depends largely on the market value of the maize. In many cases hand-planting would cost more than machine-planting, and weeds would be more prevalent and more difficult to control on the unploughed land. On the other hand, such considerations might be of small account on tobacco farms on which a reserve of labourers has to be kept in hand awaiting the arrival of suitable weather for transplanting tobacco.

Statistical analysis of the yields of these plots shows that the odds are 30 to 1 against a difference as great as 20 per cent. occurring due to chance alone, which indicates that, under the conditions pertaining to this experiment an increased yield of 15 per cent. to 20 per cent. as a result of ploughing is assured.

(To be continued.)

Extracts from the Report of the Director of Veterinary Research

FOR THE YEAR 1930.

(Concluded.)

SHEEP DISEASES.

In August and September last, Mr. D. A. Lawrence, B.V.Sc., Veterinary Research Officer of this Department, accompanied Mr. Warren, Chief Sheep and Wool Officer, Union of South Africa, and Dr. Romyn, Chief Animal Husbandry Officer, Southern Rhodesia, on an extensive tour to study the possibility of Rhodesia as a sheep raising country; Mr. Lawrence being deputed to study the matter from the veterinary point of view. Fifteen districts were visited and fifty-two flocks were inspected, and *post-mortem* examinations were made on selected animals on twelve of these farms with a view to obtaining information relative to the extent and type of verminous infection. His report shows a very serious state of affairs and confirms the warnings which have been published from time to time in the annual reports of this Department during the past twenty years. The backward state of the industry is largely due to verminosis and other diseases, but must in part be attributed to a lack of knowledge as to the proper management of sheep under local conditions. This is to some extent understandable in a new country. In Great Britain there are many breeds of sheep, with a different system of management for each. For example, the treatment of Romney Marsh sheep in their home in the south-eastern corner of Kent is entirely different to that of the Southdown sheep in Sussex, the adjoining county. These various systems have been evolved as the result of centuries of experience, and there is some excuse if the best method of dealing with the heterogeneous collection of animals locally known as sheep, under the varying conditions of Southern Rhodesia, has not yet been

determined. It does not, however, entirely excuse the serious neglect which is so often noticeable in the management of our flocks. This is emphasised because in the past considerable attention has been given to local sheep diseases which have been regarded as the primary cause of the backward condition of the industry, but, as the result of recent experience, it is now becoming clear that many of these are secondary to a general state of ill-health caused by faulty management and neglect. It is true, however, that our sheep are often veritable pathological museums, as will be seen from the following list of the internal parasites commonly encountered in them.

[*The list is for reasons of space omitted.*—Ed.]

In the past, greater attention has been given to the endeavour to discover a method of treating the diseases caused by these parasites than to attempts to prevent them. Innumerable remedies have been tried here and elsewhere, but only two have proved of any great practical value, namely, the so-called Union wire worm remedy and the carbon tetrachloride treatment of distomiasis or fluke. But even with these remedies, their greatest value is when applied to sheep in good or fair condition for preventive purposes. When administered to sheep already weak and debilitated they are less successful and may prove too drastic. A recent experiment carried out at this station has proved very instructive. Fifty sheep were sent from two farms where a heavy mortality had occurred during the dry season. These were in such low condition that half of them died during transit by rail or shortly after arrival. They contained most of the parasites enumerated in the list of internal parasites of sheep in Southern Rhodesia. Various remedies applied appeared to hasten death, and it was decided to discontinue medicinal treatment until the animals could be brought to a better state of nourishment. A number of boxes were therefore prepared, each containing maize with another ingredient, with a view to ascertaining whether the sheep had any predilection. Thus maize alone, maize and cotton-cake, maize and nut-cake, maize and whole ground nuts, maize and dried lucerne, maize and iron, maize and sulphur, maize and lime, maize and

bone meal, maize and magnesium, maize and manganese, maize and iodine, maize and salt (sodium chloride) were offered. The only preference evinced was for the maize alone, rock salt and lucerne hay, and none of the other mixtures were touched until these were consumed.

A second fifty sheep were then obtained from the same source. They were also in extremely poor condition, but not so weak as those of the first consignment. They were divided into three even groups, and were given a maintenance ration based upon the experience gained from the previous experiment. Two of the groups remained untreated and the third was treated with a carbon tetrachloride tetrachlorethylene mixture said to be innocuous. Deaths occurred in each group, but were most numerous in the third group. After a few weeks improvement was noticeable, but with the onset of the rains the green grasses appeared in the pens and the sheep refused their dry ration. It was therefore decided to turn them out to graze. In a few weeks marked improvement was noted in most of them. It is believed that the majority of them will soon be fit for the butcher. *Post-mortem* examinations of some destroyed for observation revealed a marked diminution in the number of intestinal worms. This experiment is referred to in some detail, because it draws attention to certain points of practical importance, namely, the danger of dosing sheep in too low condition, the improvement in untreated sheep when given a proper ration, the therapeutic value of the green grasses and the extraordinary recuperative powers of sheep under favourable conditions. Two other observations are of great significance. The first is that the majority of fat sheep slaughtered at the abattoirs contain numerous worms, which indicates that if a sheep is well nourished and otherwise in good health it can resist a comparatively heavy verminous infestation; and the second is that if a sheep is once in good condition it requires a very small and inexpensive ration to keep it so. These facts indicate that if the condition which is generally made during the summer months is maintained by a grain ration and preventive treatment against worms throughout the winter—commencing before any "setback" occurs—the mortality from disease will be greatly reduced.

It is proposed to carry out further experiments on these lines, for it is believed that in sheep diseases the old adage "prevention is better than cure" holds good, and that a proper system of management based upon local conditions may do much towards placing the sheep industry upon a more satisfactory foundation.

VERMINOSIS.

Diseases caused by worms are met with in most of the domestic animals throughout the territory. During the past year particular attention has been drawn to the prevalence of parasitic gastritis in cattle, which is probably responsible for many of the numerous deaths which occur yearly during the dry season, and which have hitherto been attributed to "poverty." In order to ascertain the incidence and distribution of this disease, tubes containing a preservative were issued for the collection of fæces from suspected cases, and a large number of specimens were forwarded to the laboratory to be examined for worm eggs. In this way the presence of infection was found to exist in the Lomagundi, Mazoe, Shamva, Salisbury, Marandellas, Umtali, Melsetter, Hartley, Gatooma, Gwelo, Victoria, Enkeldoorn, Umvuma and Shangani districts and Bechuanaland. Animals sent from the tsetse fly area, Gatooma, were found to be infected with trypanosomes and wire worms (*H. contortus*). It is probable that in such areas the dual infection is common and may account for the occasional failure of the antimony treatment for trypanosomiasis. It has been found at the research station that cattle infected with wire worm respond to treatment with the Union wire worm remedy when applied in appropriate doses. Unfortunately to administer this treatment entails the handling of each animal, which, under ranching conditions, is almost impossible. Cattle will sometimes take copper sulphate in a lick or in their drinking water once, but can rarely be persuaded to do so a second time. Animals have been known to refuse water so medicated for a week, although no other supply was available, rather than drink the copper it contained. At present no method of disguising the drug has been discovered. This is a problem worthy of the attention of the commercial druggists. Many other drugs have been tried as an alternative to copper, but none has proved as efficacious.

The presence of nodular worm in cattle was reported from two districts. Specimens were obtained and were submitted to Dr. W. K. Blackie, Rhodesian Research Fellow, London School of Hygiene and Tropical Medicine, who identified them as *Œsophagostomum radiatum*. Some concern was felt as to the possibility of this worm of cattle being infective to sheep and *vice versa*, the *Œsophagostomum columbianum* of sheep being infective to cattle, but apparently such cross-infection does not occur.

It should be mentioned that although rare specimens of coccidia had been encountered in the past during examination of the fæces of sheep by the sugar flotation method, no lesions were found at autopsy which could be attributed to them. In recent *post-mortem* examinations, however, even in adult sheep, severe changes were noted in the large and small bowel, the mucous membrane being considerably thickened, corrugated and in all ways similar to the lesions of coccidiosis in cattle. Sections of such pathological parts contained coccidia in vast numbers.

Schistosome ova were first observed by Mr. Lawrence during the examination of mucosa scrapings of sheep for the presence of coccidia, after which careful examination of the mesenteric and portal veins revealed the parasites. From this distribution and behaviour after death of the host, and from their general morphology, it would appear that they are identical with *Schistosoma mattheei*, Veglia and le Roux (1929). Later, the same parasite was encountered in a heifer sent from the Shangani district.

The so-called "Bankrot" worm (*Trichostrongylus instabilis*) of sheep has been found to be far more prevalent than was formerly suspected. It may be that this worm, being very small (about quarter inch long) and embedded in the mucous membrane of the pylorus, has hitherto been overlooked. But there are some flock owners who attribute their misfortune to this worm imported with sheep from the south—a possibility which should be borne in mind by intending purchasers.

MYIASIS.

This disease, which is commonly known as "screw worm disease," is very prevalent in some parts of

the country at certain seasons of the year, causing serious losses and inconvenience. It is caused by the invasion of wounds, no matter how small, by the larvæ of a fly of the "blue bottle" type (*Chrysomyia bezziana*), which penetrate the tissues, causing large cavities. In some districts the pest is so serious that even newly-born calves become infected through the navel, and the ordinary operations of castration, dehorning, branding and parturition are rendered extremely dangerous. In addition to the mortality which occurs, the loss of time and labour in dressing the wounds renders this disease a source of great expense and trouble to stockmen, and it has been described as one of the greatest menaces to the cattle industry. Unfortunately it has been found extremely difficult to devise means of dealing with this pest. The fly is rarely seen in nature, and according to entomologists is incapable of breeding in carcases; it cannot, therefore, be destroyed by poison traps, and the careful removal of dead animals plays little part in its reduction. The destruction of maggots taken from the wounds is advisable, but does not result in the final eradication of the fly. The treatment of wounds, also, is unsatisfactory. Many remedies have been advocated and some have proved more or less successful, but wounds frequently become re-infected and often months of careful dressing are necessary before a cure is effected. In view of these difficulties it was decided to endeavour to find a method of dealing with the problem. The work of Blacklock and Thompson, published in the Annals of Tropical Medicine and Parasitology, December, 1923, in connection with the Thumbu fly (*Cordylobia anthropophaga*), the larva of which causes myiasis of man, was extremely interesting. These investigators in Sierra Leone showed how in guinea-pigs, after previous experimental infection with the parasitic maggot, the plot of skin invaded by the maggot acquires an immunity to subsequent infection, this local skin-immunity tending to spread from the primary focus to neighbouring areas. They also obtained some success in the production of artificial immunity by application of emulsions of the larvæ to the skin. This idea of immunity against metazoa was new and opened up a new field of research. It introduced great possibilities and gave rise to the writer's attempt to set up an immunity against

the "screw worm" infection of cattle. In considering the matter he was struck by certain features of the disease, namely, the rapidity with which the larvæ developed and penetrated the tissues, which appeared to become liquefied and gaseous and to give off a characteristic smell. The idea occurred that these changes might be caused by proteolytic organisms, possibly of the gas-gangrene group, comparable in some respects to the quarter-evil organism—also a tissue parasite—against which an effective vaccine could be prepared. The bacterial flora of wounds invaded by the "screw worm" were studied and at last a culture was obtained which produced gases giving the characteristic smell encountered in such cases. The culture contained innumerable bacteria, and the one responsible for the gas-formation could not be isolated, but by sub-cultivation it could be reproduced. A vaccine was therefore prepared from it in the same way as the local quarter-evil vaccine. Preliminary tests yielded very satisfactory results. A few days after treatment the smell of the wounds became less and the maggots dropped out, and the wound commenced to heal rapidly. The absence of smell also reduced the danger of re-infection. But cases for experiment rarely occurred at the research station, and it was decided to issue supplies of the vaccine to stock owners who would undertake to report on the results obtained. As stated elsewhere, twenty-two reports have been received, and of these eighteen were favourable and four were not. It is clear that certain "brews" are not effective, but the reason cannot be determined until the specific organism which plays the all-important part in the infections has been isolated and identified. This is a work involving greater time and labour than is possible in the circumstances obtaining at this laboratory, where only the crudest technique is possible. The assistance of the Curator, National Type Cultures, Lister Institute, London, has been obtained, to whom our thanks are due. It was intended to cease the experimental issue until further study had been completed, but at the urgent request of those who have previously used the vaccine with success, it has been decided to continue to issue certain proved "brews" until the opportunity of placing the method upon a more scientific basis occurs.

OTHER DISEASES.

There are several other diseases into which research is urgently needed—for example, ophthalmia of cattle, which is very common, especially in well-bred stock. The cause of this disease, the manner in which it is transmitted and the best method of preventing and treating it are unknown. Unfortunately ophthalmology is a very specialised study, and requires far more attention to the refinements of technique than is possible in this laboratory.

Another mysterious disease which requires investigation is the so-called sweating sickness of calves. This also is an affection of better-bred animals, and is responsible for a heavy mortality. Here again the cause and nature of the disease are unknown, and all attempts to transmit it artificially have failed. Letters have been received from ranch managers indicating that it is becoming increasingly prevalent and urging that it is given attention.

Contagious abortion is another disease which should be carefully studied in this country, where it presents some unusual features, the most unpleasant of which is its infectivity to man. Although this characteristic was first pointed out by the writer in 1921, the manner in which the infection takes place is not yet understood. The peculiar incidence of infection and the fact that so often only one member of a family becomes infected appear to exonerate milk as the source of infection. Cases have occurred which appear to be attributable to infection from the discharges of cattle assisted during parturition, but many others cannot have arisen in such a manner. Apart from its infectivity to man, the disease, in the opinion of the writer, is the greatest menace to the cattle industry in this country. On some ranches the calf crop is so small that it is almost impossible to carry on operations at a profit. The disease is also very prevalent in dairy herds, to which, in many instances, it has been introduced by recent purchases. The results have sometimes been so serious that the disposal of the infected herd has become necessary, and infection has thus become further disseminated. Such disasters might be avoided by the systematic use of the special test devised and issued free by this Department. This disease presents such difficulties

in control that it had to be removed from the list of destructive diseases under the Ordinance, which makes it all the more necessary that this Department should find some method, as by protective inoculation, of dealing with it. The future of the cattle industry appears to depend upon success in this direction. The further discussion of this disease is impossible in this report; suffice it to say that it is "not for nothing" that in more than twenty States in America this disease is notifiable, and its control, based upon the agglutination test, is compulsory. Contagious granular vaginitis of cattle is also very prevalent and the cause of serious loss in calves and dairy products. It is commonly associated with contagious abortion, and it frequently happens that one disease "masks" the presence of the other. Various remedies are recommended, but in this disease again prevention would appear to be preferable to cure, and investigations in this direction should be instituted.

A disease locally known as "blind sickness" occurred among cattle in various parts of the Marandellas district. This was investigated by Mr. Lawrence in collaboration with the Veterinary Department, and two typical cases were brought to the Research Station for observation. It was found impossible to transmit the disease by contact, syringe inoculation or drenching with stomach contents. From the investigations in the field there appears reason to believe that it may be due to a vegetable poison, as cases cease when cattle are removed from certain grazing grounds. A botanical survey of such areas, therefore, is indicated.

There are many other diseases apparently of minor importance which require investigation, but the history of this country indicates that no disease should be neglected. East Coast Fever was at first mistaken for redwater and was allowed to travel unrestricted through the country, with the result that it cost some millions of pounds and held back the development of the country for a quarter of a century. Veterinary research, therefore, should be regarded as an insurance against similar disasters and should be encouraged.

Vegetable Growing in Southern Rhodesia.

TOMATO CULTURE.

By G. W. Marshall, Horticulturist.

Uses.—Tomatoes may be used for salads—mixed or plain; also cooked and served as a vegetable, stuffed with mince meats and baked; or converted into sauces, chutneys and jams, etc. They are also dried (sun or evaporated) and ground to a fine powder for flavouring soups and stews, etc. The many uses that the tomato may be put to adds greatly to its value, and it should find a place in every garden.

Soils.—There are few, if any, of our soils that will not produce tomatoes. They may be grown successfully on soils ranging from sands to clays, but the intermediate soils (loams) are undoubtedly best and should be chosen where possible.

Manuring.—Where manure is used for growing tomatoes, it should be applied to the soil for the preceding crop, for if freshly applied it may encourage excessive leaf growth and reduce fruit production, and may also lower the resistance of the plant to disease.

The amount of manure to apply varies, but the average soil would require approximately one full wheelbarrow load or sackful to 15 square yards; this amount should be applied to the crop preceding the tomatoes, and it will then be sufficient for both crops.

Fertilising.—Tomatoes prefer an acid soil, and this soil condition may be maintained by the application of a liberal dressing of superphosphate.

Broadcast one to two pounds of ordinary high grade superphosphate, 17 per cent. to 19 per cent., P_2O_5, to each ten square yards of tomato soil. It should then be dug in as the beds are being prepared for planting.

Time to Plant.—Seed may be sown where no frosts occur at any season of the year, but as frost-free areas are fairly limited, plantings should be made to furnish winter and early summer crops. These out of season crops are usually more remunerative than those harvested at other seasons.

Seed may be planted in the frost-free zones at monthly intervals from February to December. The earlier plantings in the colder zones should be made in cold frames where they can be protected during cold nights.

Seed.—Home-grown seed is good if it is collected from healthy plants which produce good crops of large, fleshy fruit. The quality of the fruit from which the seed is collected is the determining factor in subsequent crops, and growers are consequently advised to plant nothing but the best of seed.

Most seedsmen catalogue and sell the popular varieties, and there is little or no danger of disappointment if the seed is purchased from a reliable seedsman.

Varieties.—Medium to large size, firm and fleshy red tomatoes are most favoured, and this type must be planted if the crops are to be marketed. Small and watery, as well as yellow varieties do not find a sale if the former types are available.

The following varieties will comply with the requirements of really good tomatoes: Wood's Improved Beauty; Bonny Best; Beauty; All Best; Best of All; Earliana; and for a very large red, Ponderosa. Besides those enumerated, there are many others equally good and well worth testing.

Seed Sowing.—Seed may be sown either *in situ* or in seed beds. The former method of planting is only recommended during the rainy season. The "hills" should be spaced three feet by three feet and about ten seeds planted to each hill, and the plants thinned out to single plants when two to three inches in height.

When seed is planted in beds or tins it should be sown very thinly, or it will become necessary to prick the plants into other beds and tins. The best method to adopt, provided the seed bed is well prepared, is to plant the seed very thinly in rows three inches apart and then thin the seedlings when one to two inches high to two to three inches apart in the rows. This will obviate any setback which may occur when pricking out, as the seedlings may then be lifted with a good ball of earth attached to their roots and transferred to their permanent positions.

Seed should not be covered with more than one-quarter of an inch of soil, and the beds should receive water every evening until the seed germinates—usually seven days.

Pricking Out.—It is necessary to prick out tomato seedlings which have been planted too thickly. The best stage of growth for this operation is when the plants are about one to one and a half inches in height, or when they have formed their second leaves. Many growers prefer to prick the seedlings into half petrol tins cut lengthwise; these tins are very suitable, and if filled three-quarters with good, loamy soil, they will take twelve to fifteen plants per tin—three rows of four or five plants each. This number of plants should not be exceeded, as closer planting produces spindly and delicate plants.

Seedlings may also be set in well prepared seed beds, usually at the same depth as they stood in the tins. The espacement of the seedlings may then be from one and a half by one and a half to three by three inches.

All seedlings must be watered immediately after they are pricked out, and then daily in the evening until well established. They can then be watered at intervals as or when required. Over-watering induces weak growth, which is detrimental to the health of the plants.

Transplanting.—The seedling plants may be transplanted when they are three to six inches in height, but care must be exercised in areas susceptible to frosts to see that the plants are adequately protected from injury. The plants will receive little or no check in their growth if they are lifted with a good ball of earth attached to their roots. The plants may be set slightly deeper than they

stood in the seed bed; lanky plants may be set more deeply. Deep planting is not harmful, as the plant is capable of developing roots along the underground portion of the stem. If the plants are young and tender when transplanted and the season is hot, it may be advisable to pinch off at least half of the leaf surface, but not the terminal bud or immature leaves.

Distance to Plant.—The usual distance for planting tomatoes is three by three feet, but this distance may be increased if the soil is very fertile and strong growth is expected.

Hardening Off.—If plants are very tender—a condition produced through forcing in shady spots—they should be hardened off before planting in the field. The plants should be exposed gradually to outside or sunny conditions for at least a week; one hour's exposure may suffice for the first day, and then it can be increased daily until the plants are fit to transplant.

Staking and Pruning.—Training the plants to one or more stems or stakes is an advantage for home or commercial production. The stakes may be made of any saplings, reeds or split timber or bamboo, and should be at least five feet in length and one to one and a half inches in diameter. These stakes should be driven into the soil within a few inches of the tomato plants; then, as the plants commence to grow, they should be tied to these stakes with raffia or similar tying material. Weekly tying may be necessary to ensure good, straight stems. It is not advisable to retain more than three stems per plant; one is the usual number.

Shoots in excess of the desired number should be removed as they appear. This may be done at the time of tying. When the plants have reached the top of the stakes, the tips may be pinched out to speed up the setting and development of the fruit crop.

If the plants are set three by three feet, the stakes may be set as shown in the following diagram:—

TS	ST	S=Stake
TS	ST	T=Tomato plant

and the tips drawn together to form a small hut or tent frame. This system has many advantages, the chief of

which is that the fruit crop, which is usually heavy, will hang on the under sides of the stakes, where they are protected from sun scald or other injury.

Watering.—As already stated, tomatoes do not require a great amount of water. This statement is verified by the volunteer plants to be seen in most gardens where they receive little or no water and produce good crops of fruit. All plants should receive a fairly liberal amount of water after transplanting, until they are established. Weekly applications of, say, one gallon per plant for the first month, then fortnightly applications of two gallons per plant until the fruiting stage, after which four gallons may be given each fortnight. Over-watering produces very rapid growth, and the plants are more susceptible to disease.

Cultivation.—Cultivation must be frequent and thorough. The soil surrounding the plants should be loosened after each watering.

Harvesting.—Tomatoes for marketing should be harvested when they commence to turn colour, for if harvested perfectly green, they lose flavour, and, although they become a normal colour, they are unsaleable. Tomatoes may be harvested with their stems attached. They then have a nicer appearance, but care must be exercised that the stems are clipped well up against the fruit to prevent injury to the other tomatoes packed in the same containers.

Grading.—All tomatoes for marketing must be graded to uniform sizes, as ungraded tomatoes are difficult to pack and considerable waste is likely to occur in the stores where the ungraded fruit is continually being picked over.

Packing.—The usual size of a tomato box is 18 inches by 9 inches by 5 inches outside measurements, and it holds about 10 lbs. of fruit. Other boxes may be used, but not larger than half petrol cases, which hold 25 lbs. of tomatoes.

All boxes must be packed firmly; this prevents fruit movement and injury while in transit to markets. Fill all boxes with fruit and not with packing material—wood-wool, etc.

Rotation.—Tomatoes must be rotated with other crops, and care must be exercised that they do not follow potatoes, which are susceptible to diseases affecting tomatoes.

A suggested rotation would be as follows:—

1. Manured cabbage crop.
2. Unmanured tomato;
3. Manured lettuce;
4. Unmanured carrots;

or—

1. Manured lettuce;
2. Unmanured tomato;
3. Manured peas;
4. Unmanured beans;
5. Manured potatoes.

Insect Pests.—Space does not permit of dealing with this factor, but it may be stated that the tomato in this country is singularly free from pest injury. A few leaf and fruit-eating insects are at times troublesome, but hand collecting is usually sufficient to control them.

Diseases.—Tomatoes are susceptible to several diseases, but mainly blight, stem-end rot of the fruit or mosaic. As most of the diseases are incurable, it is advisable to adopt the adage "prevention is better than cure." Spray the plants fortnightly with Bordeaux Mixture at a strength of 4.4.50.

AT STUD.

The thoroughbred stallion Dark Dragoon is available for stud purposes. Service fees, £1 1s. per mare, plus 1s. per day for feeding, stabling and attendance. Only mares of *bona fide* farmers will be accepted. Service application forms and further particulars may be had on application to the Principal, Matopo School of Agriculture, P.B., Bulawayo.

Extracts from the Report on the Work of the Cotton Breeding Station, Gatooma,

FOR THE SEASON 1929-30.

(Concluded.)

By J. E. PEAT.

Ratoons.—An acreage of some four acres was ratooned on 5th October, 1929, as an observation trap crop. The area was flowering by the first week in November. Towards the end of November very small Sudan bollworms were seen on the plants and occasional American and Spiny bollworms; in December, there were mainly Sudan, with occasional American and Spiny bollworms. On the 8th and 9th January counts were made on scattered groups of plants through the plots. On a total of 766 plants, 379 bollworms were collected, *i.e.*, 0.5 per plant, the distribution being 53.8 per cent. Sudan, 16.9 per cent. Spiny, and 29.3 per cent. American. The area was then cut back, leaving one stalk per plant which was carefully picked clean. On January 17th a further count was made on scattered groups of plants, 639 plants in all. One hundred and twenty-three bollworms were collected, *i.e.*, 0.2 per stalk plant, the distribution being 32.5 per cent. Sudan, 23.5 per cent. Spiny, and 44 per cent. American. The stalks were stripped, leaving only the terminal buds and leaves and one side shoot. These were picked clean. A further count was made on 31st January, after which the ratoons were uplifted; 449 plants were examined in scattered groups as before. Two hundred and forty-four bollworms were collected, *i.e.*, 0.54 bollworms per stalk plant, the distribution being 70 per cent. Sudan, 27 per cent Spiny, 3 per cent. American. All the bollworms except the Sudans were very small, obviously from a new egg-laying. The results show

that should Sudan become more serious, good results might possibly be obtained by the extensive use of ratoon trap crops. In farm practice ratooned trap crops would have to be fairly regularly watched, requiring probably regular grazing.

Nothing is known about the natural food plants of Sudan bollworms, nor how much migratory movement there is by the first moths at the beginning of the season carrying them into the potential cotton areas. This coming season further work will be done with ratooned trap crops and a wide collection of malvaceous plants will be planted out on the station in an attempt to get some further information about the natural food plants.

There was not the heavy attack of American bollworm on the maize that there was last year. It would almost seem that the American bollworm brood which last year attacked the maize in March, this year attacked mainly the cotton instead; and that the next brood coming along at the end of March and early in April, attacked the cotton as it did last year, and as in the 1925-26 season.

In April on the station, there was a very sudden and very heavy attack on the Sunn hemp which was then being ploughed in, possibly part of the second main brood. Flights of swallows put in an appearance and appeared to be feeding continuously on the larvæ. A count on 19th April, after the swallows had been feeding for two or three days, showed a population of 42, mostly well grown, to the square yard of Sunn hemp. Another area of Sunn hemp in the Bagley portion of the station was much more lightly attacked, and no other similar attacks were seen in the district.

Trap crop maize was planted at intervals as in other years, but did not appear to be particularly attractive to the American bollworm. Counts in the middle of April showed on the average only every third plant attacked, in marked contrast to the very heavy attack on the trap crop of maize by the April brood last year.

These attacks at Gatooma of the past two years are very different from the sort of attack which is experienced around the Corporation's station at Barberton. There the attacks seem to consist of a heavy infestation by one brood, the next

brood probably moving on. Control measures will, therefore, probably be different in the two areas.

It is essential now to get a more complete picture of what is happening in the districts. It is thought that most of the damage this year was done by American bollworm, but this is only based on scattered observations in touring. It is necessary to have records of the attacks from these areas, the periodicity of serious attack, the seasonal distribution, the dates of the main broods, and an analysis of the attack, *i.e.*, how much of the attack is due to American, Sudan, and Spiny bollworm respectively. This coming season records of this nature will be made by native recorders, trained on the station, in sub-posts in the Mazoe, Lomagundi, and Bulawayo districts. They will be under white supervision, and supplementary general observations on pests, on natural food plants, broods and attacks on other crops will be made by the supervisor throughout the areas. The observations on bollworm attack in the country—though scanty—appear to show the main damage to have been done by American bollworm, and in March and April. Measures of control must, for the present, be based on this, but it is being borne in mind, in considering possible control measures, that attacks of American bollworm may occur earlier in the season, and that Sudan bollworm may become more serious than it is at present.

Two seasons out of five on the station, bollworm damage has been negligible, and in the past two seasons a proportion of growers have escaped attack. Thus, even without direct measures of control, such as parasite liberation or dusting, there will be seasons when the natural factors are unfavourable to bollworm. In a season of bad bollworm attack, such as this, only a proportion of growers were severely hit, and some of those who suffered badly last year had a light attack this year, and *vice versa.*

Planting cotton as early as the rains permit would appear to be important, and probably priority over maize should be given to it. As will be described later, multiplications of one or two Gatooma sub-strains of U 4 have shown up over the past two years of bollworm attack on the station as markedly superior to the Mixed Bulk U 4, which is the general U 4 grown in the districts, setting and holding on to

a fair early crop. Yields from spacing trials have shown the benefits of a closer spacing than that in general use. The closely spaced plants of the better strains have given a fair yield this past season, in spite of the bad bollworm attack contrasted with the poor returns of the Mixed Bulk at the commercial spacing.

Jassid.—The jassid distribution for the year is much the same as last season. Durango collapsed in April; Bancroft showed the usual signs of distress; the Cambodias were highly resistant, and the U 4 lots satisfactory. The nymph counts were made weekly in a series of small plots in a jassid observation block from ten marked plants, five leaves on each or fifty leaves in all. As Durango started to collapse, only the younger leaves could be used for nymph counts on plants of that strain; these were small in area contrasted with the bigger leaves of other strains. Thus in the later part of the season there was a much heavier attack per area of leaf in Durango than is brought out in the graph.

On the whole the U 4 Mixed Bulk lots throughout the country have shown up satisfactorily as regards jassid resistance, just a crop here and there suffering slightly.

The Mixed Bulk on the station, which is segregating into a mixture of types, showed a small percentage of plants suffering. This small percentage of less resistant plants is sufficient, under conditions favourable to jassid increase, to allow a breeding up and thus a more general attack in the Mixed Bulk than there would have been had the plants been all uniformly resistant. The multiplications of the U 4 lots for issue were more uniformly resistant, and all appeared satisfactory. Use could not be made of differences in resistance in selection in the single plant lots, as all appeared satisfactory. There is undoubtedly a variation from lot to lot which a bad jassid year might show up. The counts on the plots of U 4 multiplication lots in the jassid observation block show a slightly different type of attack from lot to lot.

Standover cotton, ratoons, or ratoon trap crops left in too long, would probably serve as breeding grounds for jassid, to give an early bombardment of the annual crop.

Stainers (Dysdercus spp.).— On the station, stainers were numerous, flighting in from the veld—as numerous as in any year in the last five. A fair amount of stainer damage has been reported from other areas, varying in amount from farm to farm. It is considered that on the station a fair check was effected by the system of trapping practised. A number of growers in other areas also obtained satisfactory results from the use of traps.

U 4.—Nineteen U 4 sub-strains were grown in observation multiplications, but none appeared so promising at /64, and to a lesser extent, /26. /117 yielded fairly well when growing on land in which Sunn hemp had been ploughed under the previous year, but the lint tended to be soft. In the same area /128 and /39 also yielded fairly well. Some further selections from the multiplication bulks were made.

Special Bulk U 4.—The Special Bulk U 4 issued to growers for multiplication this last season did well on the whole. Plots were well looked after and some very good yields were obtained, quite a number exceeding 1,000 lbs. seed cotton per acre with a very thin rate of seeding and wide spacing. The Special Bulk is undoubtedly intrinsically better in yielding power, uniformity of jassid resistance, and in lint quality, than the general U 4 Mixed Bulk, but it definitely is not as much better as some of the yields would appear to show. It was generally given priority in planting, on good land, and was better looked after than the ordinary cotton; being generally in a small isolated block, moreover, it did not usually suffer as heavily from bollworm attack as the bigger areas of Mixed Bulk. A considerable area will be commercially under U 4 Special Bulk this coming season.

Varieties other than U 4.—No variety or strain other than U 4 gave satisfactory results. Observation plots were planted out to Cambodia, An.12, Z.1, and Bancroft selections; Durango, Punjab, Americans, and Turkestan cottons. All failed in one way or another. The Cambodia selections, though excellent as regard jassid resistance and more moderate in growth than the original Cambodia, were later than the U 4 lots, and with their big bolls suffered badly from bollworm. There is no alternative in sight to U 4 and the U 4 sub-strains. If for any reason U 4 or the selections

from it could not be grown, very little cotton would be planted until something could be bred to replace it.

Spacing Trials.—Spacing trials were conducted on the station and by a number of growers throughout the country, using the commercial U 4 Mixed Bulk. We are greatly indebted to the growers who have carried out trials, both spacing and fertiliser. The interesting results that are being obtained fully justify the labour involved. The results are definite, and markedly in favour of a closer spacing than that at present adopted. Six inches in the row, the closest spacing tried, gave the best results, not only where the bollworm attack was severe, but on a rich farm at a low altitude where the bollworm attack was negligible. The style of growth of the 6-inch plots under these conditions appeared better than at the wider spacings.

A Harland trial, *i.e.*, with groups of plants in each line with spacings 1 inch to 30 inches, laid down more or less to see how it would work, and with flowering and bolling records for each spacing taken across the rows showed results all in favour of the close spacings. As far as can be seen, the lint from the 6-inch plots was much the same in quality as that from the plots at the wider spacings, considering, of course, it was all Mixed Bulk, from which the lint is soft.

This coming season, growers in other districts are undertaking a further set of trials, using 12 replications instead of 8, with slightly smaller plots than last year. On the station composite trials on the Fisher system will be laid down combining strain and spacing comparisons, so that some idea of the response of the different strain types to the different spacings may be obtained. No definite advice has been given to growers for this coming season. They have been informed of the results of the trials for last season, and it has been suggested that they should try at least a small proportion of their lands at a closer spacing, say 6 inches, even though they cannot lay down small plots for comparison. A number of growers in each district will lay down definite trials. At the same time, they have been warned of the possible dangers of close spacing—dangers which are, however, probably less likely to eventuate in Southern Rhodesia than, say, in the Barberton areas—bearing in mind the later planting dates

in Rhodesia, and the necessity in most areas of setting an early crop.

Firstly, there is the possibility that closely spaced plants would not have the same powers of recovery from a serious early drought; from the rainfall figures available that does not appear to be so likely in the present cotton areas in Rhodesia as in some areas in the Union. Secondly, should a bollworm attack come earlier than it has done so far, say in early February, the more closely spaced plots might not have the same powers of recovery as those at a wider spacing. The attacks that are recorded hitherto have been in March and April: for such attacks a close spacing is a marked advantage. There is probably not the same chance of an early attack in a country under so much maize as, for example, at Barberton, where the typical attack seems to come from one brood which then passes on. Again, the recovery of a late crop after bollworm is to some extent problematical in many of the areas in Rhodesia, owing to the falling temperatures recorded in May in some seasons.

The early crop is undoubtedly the best and, among other ways of securing it, closer spacing should be especially useful, if the possible dangers mentioned above appear not too considerable: it is only by further observations and trials throughout the country, and over a number of years, that a more complete assessment of the advantages and disadvantages of close spacing will be possible. It will be necessary also to watch the effects on quality of the different spacings in the different seasons.

Fertiliser Trials.—Fertiliser trials were undertaken on the Station and by one or two farmers in other districts, using U 4 Mixed Bulk. The applications tested were of phosphates, potash, and the addition of sulphate of ammonia to a phosphate dressing. Records have been kept of previous crop and fertiliser applications. The results are indefinite; on the station only very slight responses were recorded. In none of the trials were any differences between plots visible to the eye. The fertilisers were applied by hand to the rows before planting, and plots hand-harrowed. The application was thus a surface one. The results from the Tobacco Station, Salisbury, though from groups of plants in plots with a bad stand, and thus of doubtful significance, indicate

the possible benefits on sand veld of a superphosphates application. Results from another farm in the Gatooma district show significant increases on the application of superphosphates and of potash. A farmer in the Lomagundi district unable to carry out trials, recorded no increase from a potassic superphosphate application, 150 lbs. per acre; nor when touring did one receive from farmers reports of benefit to their cotton crop by the direct application to it of fertilisers, as one does in the case of other crops.

Farmers are being urged to experiment for themselves with fertiliser applications, but in the meantime, rather to fertilise crops known to respond to direct application, and to plant cotton after them. Much more information is needed before recommendations can be made with confidence. The problem may be quite different on the sand veld, and may vary with different methods of application, for example, with fertiliser ploughed in, instead of applied to the surface. Further trials are being undertaken by growers in the districts, and for each trial, a record is obtained of the previous treatment of the land and crops grown.

Cotton on the station grew well on land green manured with Sunn hemp in the previous year, and repeatedly good crops with a healthy style of growth have been seen growing on land down to tobacco, fertilised the previous year. This coming season on the station, plots will be laid down to run for a year or two under varying fertiliser applications, combinations, and treatments.

U 4 Sub-strains—Seed Cotton and Lint Characters.—A general complaint about Rhodesian cotton this season has been the softness and lack of character of the lint. The possible seasonal causes of this have already been discussed. While most of the lots grown on the station are on the soft side this season, some being distinctly soft, several show quite a moderate strength. /64 and the /64 re-selections are quite good, and /130 is good. Mr. Hesse, of the Central Co-operative Cotton Exchange, Limited, Durban, in a note on lint bales from the station, while commenting on the softness of the general Mixed Lots, stated that some of the cotton pulled beautifully, was excellent in strength and character, and was far superior to any other cotton that he had handled from Rhodesia.

Unfortunately, the lint of /26 appears to be rather on the weak side. A Special Bulk of /26 which appears slightly better is being multiplied. Most of the re-selections from the /26 multiplication bulk appear fair. /130 is a slightly better stapled cotton than the other families under multiplication. The lint of /64 is of good staple and uniformity, while /26 is possibly slightly longer but less regular. In ginning percentage, /64 is slightly lower than the run of lots—33 per cent. to 35 per cent.—(bulk-ginned on the station 50-saw power gin): /26 gins about 38 per cent. to 38.5 per cent., with some of the re-selections slightly lower; /130 gins about 36.5 per cent.; and /117 about 37.5 per cent. The other good qualities of /64 are, however, more than sufficient to compensate for this slight loss in ginning percentage.

DATES OF AGRICULTURAL SHOWS.

Umtali Agricultural Society, Umtali, 24th and 25th July.

Bindura Agricultural Society, Bindura, 25th July.

Rusape Agricultural Society, Rusape, 7th August.

Rhodesia Agricultural Society, Salisbury, 26th and 27th August.

Bulawayo Agricultural Society, Bulawayo, 2nd and 3rd September.

The Rhodesia Railways have agreed to grant the same concession on the road motor service as that allowed when show exhibits are sent by rail, *i.e.*, full rates will be charged on the forward journey, and, if unsold, the exhibits will be returned to the senders free of charge, provided the necessary certificate is obtained from the secretary of the show.

Owing to the outbreak of foot and mouth disease, the Executive of the Midlands Agricultural Society has decided to postpone the Gwelo Show, advertised to be held on the 12th June, to a date to be notified later.

Poultry Husbandry in Southern Rhodesia.

SELECTION OF EGGS FOR INCUBATION.

By H. G. Wheeldon, Chief Poultry Expert.

The eggs of well-bred poultry differ in size, shape and texture of shell. This variation of hens' eggs is due in a large measure to indiscriminate selection and breeding. Observation will not only reveal differences when eggs of various hens are compared with one another, but the eggs produced by the same individual differ in size, form and finish.

The feeding and management is likely to have some influence on the size and texture of eggs laid by the flock. Small, round eggs, with relatively large yolks and little albumen are frequently caused by a deficiency of protein in the ration. An excess of albumen and a deficiency of yolk are caused by feeding an unbalanced, nitrogenous ration. Abnormally large and double yolk eggs are the result of excessive activity of the egg producing organs.

As the size, shape, texture and colour of the shell are to some extent hereditary, they may be controlled or made characteristic of any strain of fowls by careful selection of the eggs before incubation. These desirable qualities have an important economic value and form essential points in good quality market eggs. As egg farming must return a reasonable margin of profit, their economic significance should be an inducement for commercial egg farmers to take every precaution in producing eggs uniform in size and other qualities.

The standard size of first grade eggs is two ounces. Although there may exist no definite correlation between

the total number of eggs which a hen lays during the year and the number or percentage of first grade, medium and small eggs, egg size has some bearing on inheritance; therefore, selection for this factor must be added to those which the poultry breeder should bear in mind with the selecting of breeding stock and eggs for incubation. A hard and fast rule should be to discard from the eggs required for incubation all those under two ounces in weight.

The improvement may not be pronounced the first year; to be successful the selection must be continued regularly year after year. To do this with the greatest effect and the least possible time, it will be necessary to use as breeders only females which have been trapnested and the egg weight recorded during their pullet year and classified accordingly, followed by the selection of males from the best females. Preference should be given to the eggs produced by hens with vitality; and the best results are often obtained from birds in their second or third laying year. Small and very large eggs are not desirable.

In selecting eggs for incubation, uniformity in shape and average size should be the deciding factor. It is unusual to obtain satisfactory results from misshapen eggs, especially from those exceeding 2¼ ounces in weight. They should be characteristic in shape and the shell well finished. Eggs that are very long, round, irregular or otherwise abnormal in shape should be discarded even if they weigh two ounces.

Special care should be given to the texture of shell. Examine and discard all the eggs that by sight, touch, sound or any other means appear to be defective or liable to produce an undesirable chick. Coarse or rough porous shells are often thin and papery, and are rejected by experienced breeders. The shell should feel solid and smooth to the touch and be of close texture with uniform colour.

The appearance of white shells is materially improved by careful selection of the purest white shelled eggs for incubation. For the production of brown or tinted shells, clearness and uniformity in colour should be given preference according to the shade of colour preferred. The first eggs laid by pullets are darker in colour than those produced at the end of the laying season.

Review.

"FUNGOUS DISEASES OF PLANTS."
(Second Edition.)

By JACOB ERIKSSON.

(Baillière, Tindall & Cox, London. Pp. viii.+526, with 396 figures in text and three coloured plates. 35s.)

This is the second and greatly enlarged edition of the well-known book by Professor Eriksson, "Fungoid Diseases of Agricultural Plants," published in 1912. The English translation from the German has been admirably performed by Dr. Goodwin, of the Agricultural College, Wye. The system of classification by causal organism has again been adopted, but a host index is included as an appendix, so that ready reference to the text is obtained. Further references to particular diseases are to be found in bibliographies which follow the descriptions of the chief forms, whilst for workers who may require to see original papers, the authors' names and dates are given in parenthesis in the text. The book is profusely illustrated by photographs and drawings, the coloured plates of *Puccinia graminis* on oats, *P. dispersa* on rye and *P. glumarum* on wheat being again reproduced. Many of the figures, such as blossom-end rot of tomato on page 26 and *Peridermium strobi* on pages 222 and 223, bring out the symptoms of disease in a striking manner, but a few show little more than silhouettes of the affected parts and are not calculated to be of great assistance in diagnosis. In the same way, the exclusion of technical descriptions of organisms and the free use of synonyms makes necessary the possession of an extensive library for absolute determination of a newly-recorded disease in any particular locality. As such facilities are seldom at the absolute disposal of the isolated worker, the value of the book to the lone mycologist is somewhat diminished.

The chapters on the downy mildews, smuts and rusts occupy 171 pages, of which 94 are devoted to the latter and receive very comprehensive treatment. It is most surprising, however, that a work which includes such up-to-date information as Craigie's observations on the function of rust pycnia should at the same time include several pages upholding the almost totally discounted theory of "Mycoplasm," a first cousin to the "Spontaneous Generation" of the 19th century.

A good account of diseases due to the Ascomycetes is contained in 182 pages, but only 55 pages are given to the *Fungi imperfecti*, which include, however, the principal European forms. The disease called Early Blight of potato is attributed to the fungus *Sporodesmium solani varians*, which is stated to be identical with *Alternaria solani*, but the fungus shown in Fig. 371 does not agree with the accepted descriptions of *A. solani*, whilst the symptoms on the leaves are more reminiscent of Late Blight than Early Blight, and can hardly be said to tally with the author's description in the text.

The book concludes with a useful summary of general methods employed against plant diseases and gives some interesting notes on international action for their control.

"Fungous Diseases of Plants" will make a most useful addition to the library of the general plant pathologist, whilst the many references to literature will be of much assistance to the research worker. The book is printed in clear type upon good quality paper and is bound in a serviceable cloth cover. Every mycological library should have a copy upon its shelves.

J. C. F. H.

Correspondence.

[*No responsibility is accepted by this Journal for the views expressed by correspondents.*]

The Editor,
Rhodesia Agricultural Journal.

Sir,

"OUR FOOD SUPPLY."

I notice that in your April issue you draw attention in your editorial notes to the considerable importations of foodstuffs into Rhodesia and comment upon the reason.

This question of importations is so frequently being brought up and discussed that I think we should preserve a certain sense of proportion in the matter. There are certain foodstuffs that we cannot produce and which consequently must be imported; then there are foodstuffs which we can produce, but not at a price to compete with cheaper production in the Union; and then we have articles we can produce, but our methods of marketing are inferior that we lose the market to more efficient competitors. Finally, it must be emphasised that Bulawayo is the centre of a very great re-export trade, and this must always be taken into consideration when we note the large amount of imports.

Fruit.—Bulawayo is a very important centre for imported fruit, which comes up in very large quantities from the Union; a large amount is re-exported. A lot of the fruit like grapes, bananas and pines are not produced commercially in Rhodesia. Peaches and plums are of very inferior quality to the Cape fruit. This Cape fruit comes up beautifully packed and graded and sells at most reasonable prices. Cheap fruit is an important item in the dietary of a family. Local citrus fruit obtains good prices when properly packed, but so many people send fruit into market just thrown in anyhow into an old grain bag. Modern experience shows the value of selection, grading, branding and packing. Occasional consignments are useless on a perishable market; you have to

average your prices. One day may see a glut and another a famine, but perishables cannot be carried over.

Vegetables.—Local production of a cheap, bulky article which loses freshness by transport has a considerable lead, and yet on frequent occasions big importations have to take place from the Union owing to total lack of local supplies. Cabbages and carrots along with tomatoes are the main lines imported. A lot of tomatoes are handled from Mr. Morkel, of Shamva, and he usually gets top price, as he grades and packs well; he also sends regular consignments so that big purchasers can rely on supplies; odd lots of vegetables go nowhere. As far as potatoes and onions are concerned, large quantities are handled, and largely for re-export; here the reason for importation is mainly price, grading and regularity of supplies. The Union grower does not dump, but in big scale production is quite satisfied with a low price. In the Union the price of these products is low; only an embargo could stop this competition.

Bacon.—A talk with a grocery store will soon show the reason for this importation. No one wants bad bacon, and it is the most finicky article of food handled; there is nothing cheap about bad bacon. The local merchant cannot obtain reliable brands of good bacon, therefore he must import. Bacon certainly is an article that should be locally produced to meet all our demands.

Cheese.—The same reasons apply as to bacon.

Eggs.—A great deal of re-export is done in this commodity, and competition is very keen up north with Union supplies. Local prices must meet import prices, otherwise importation takes place. The Rhodesia Egg Circle has done the bulk of importation in recent years, and is at the present time importing. Some little time ago I required large quantities of graded eggs—that is, I required regular supplies of eggs weekly of certain tested grades—the Rhodesia Egg Circle was unable to supply, so I was compelled to import from the Union. The Union eggs, I may say, are of better quality than local eggs and are usually cheaper in price, even after allowing for transport charges.

There would seem to me to be no mystery about importations.

Yours faithfully,

X. X. X.

[*Despite the views expressed by our correspondent—whose letter we are pleased to publish—we consider that all the products mentioned in our editorial article could and should be supplied from local resources. It is quite true that certain of the imports are re-exported to the north, but surely, by reason of our geographical position, we should be able to supply the needs of those markets. There has certainly been a lack of orderly marketing in the past, but we hope that with the creation of the Producers' Direct Supply Co-op. and the extension of its operations to other parts of the Colony, difficulties in this respect will be overcome. As regards bacon and cheese we do not agree that the local product is inferior to the imported. Admitting that at present eggs are imported from the Union to maintain contracts in the north, we do not consider this should be accepted as a policy for all time.*

These are all matters which should receive the earnest consideration of primary producers, for we feel convinced that by proper organisation a large and profitable market is within their reach.—Ed.]

Seeds for Sale, Gwebi Farm.

S.E.S. Hull-less oats	40/- per 150 lbs.
Large black sunflower seed	14/- per 100 lbs.
Linseed	60/- per 200 lbs.
Linseed in quantities less than 100 lbs in weight,	4½d. per lb.
Sweet potato tubers (Calabash variety)	6/- per bag of 150 lbs.
Napier grass roots	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

Farming Calendar.

June.

BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

CITRUS FRUITS.

Cultivation of the grove is to be continued. Early ripening fruit must be harvested and marketed without delay. Mid-season varieties will be fit for packing early in the month. These should be shipped as early as possible, so as to extend the late variety export season as much as possible. Most late ripening varieties will require irrigating during the month.

A small amount of pruning should be done. If fumigation is to take place, remove the small branches that touch the ground, cut out all dead wood and water shoots.

CROPS.

Select seed from the very best of your own crops. It is always wise to keep more seed than you may need for planting. Do not shell and ride your maize to the railway unless it is fit for export or market. If in doubt regarding the moisture content of the maize, send a 2 lb. sample in an air-tight tin, such as a golden syrup tin, to the Agricultural Department and have it tested. Provide ample dunnage for your maize stacked at the railway or on the farm. Use maize cobs; husks are almost useless for this purpose. Sew your bags of maize according to the export regulations and stack them properly at the railway side, leaving plenty of room between the double rows. Select pumpkin and melon seed from the best specimens. Support your agricultural show and make it a success by preparing and entering as many exhibits as you can. No one is more to blame for a poor show than the farmers themselves. Make a list of the seed requirements for next season, and where purchases must be made, place the orders early.

In cleaning up the cotton fields care will have to be exercised in the supervision of the pickers. The cotton harvested at this period of the season generally comes from late bolls naturally matured and those prematurely opened by the cold weather and frost. The matured seed cotton should be kept entirely separate from the immature seed cotton. There will also be some dirty and stained cotton in this final picking. Arrangements for next season's seed requirements should receive consideration.

Veld fires must be anticipated, and if not already attended to, the mowing or burning of fire-guards, both boundary and internal, should be proceeded with.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. During the winter months

the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. During cold weather it is frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

Under the cool conditions which obtain from this time of the year onwards, cheese-making operations are usually most successful.

Care should always be exercised, however, in using evening's milk. If the milk is over-acid it should not be used, or a hard, dry cheese will result. Morning's milk plus a starter usually gives the best quality of cheese. The starter should have a clean sour taste and smell. In early winter, milk for cheese-making frequently contains a high percentage of fat, and in order to firm the curd properly in the whey it is usually necessary to raise the scalding temperature a few degrees.

At this period of the year winter feeding of dairy stock should commence in real earnest. The milking cows should now be in fairly good condition, and in order to maintain a full flow of milk throughout the cold, dry months of winter, it is essential that liberal feeding be practised. As far as possible an attempt should be made to imitate summer conditions by feeding an abundance of succulent and palatable food. Maize silage, sweet potatoes, pumpkins, etc., are very useful for this purpose, but these feeds should be supplemented by dry roughage of good quality, preferably a legume hay, and a liberal allowance of mixed concentrates.

For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

General pruning may be done this month if the leaves have fallen. This should be confined, as far as possible, to the thinning out of diseased, weak, broken and dead shoots. Tall trees may be reduced in height, and old and unprofitable trees headed back to induce the growth of new fruiting wood. Trees that shed their leaves late may be pruned in July. The necessary preparations for planting trees should be completed during the month and planting commenced towards the end of the month. Cultivation should be continued.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during June.

Onions.—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials,

shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

FORESTRY.

Care should be taken by further ploughing of land or burning of grass that all fireguards round plantations are in good order and effective. Thinnings where necessary may be continued, and fellings which are to be made are to be carried out. Cuttings may be taken and struck now of deciduous trees, such as the Carolina poplar. The pricking out of conifer seedlings into tins should be continued, and sowing of such seed for the coming planting season may be completed. A commencement may be made of preparation of land to be planted during the ensuing season, e.g., by stumping if necessary, and ploughing where practicable.

GENERAL.

Grazing is deteriorating, and the next few months may be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire guards to prevent grass fires should be looked to.

POULTRY.

The poultry keeper must be on the look-out for sudden cold snaps, for if some precautions are not taken, the production of eggs will drop.

This is one of the poultry keeper's busiest periods, but method, cleanliness and attention to details pay him well. Do not leave anything that you can spare the time to do yourself to natives. Watch carefully your breeding birds, and on the slightest sign of one going off, take him or her away; if left, you will have infertile eggs, weak germs, weak chicks difficult to rear, and later weak and unprofitable stock. See that the male bird has all the food he requires, and give him a meal by himself twice a week, also a small piece of raw meat three times a week. Those who are using incubators should watch the temperature of the room on cold nights, for variations in temperature result in delayed and poor hatches, and often deformed chicks.

STOCK.

Cattle.—Where it is necessary to move cattle to fresh pasturage, this should not be unduly delayed. Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground nuts, ground

nut cake or bean meal. Young calves are better in the pens on very cold mornings until the sun has gained some power, when they may run on short sweet veld for a few hours. The above remarks with regard to dipping and water supply apply equally to dairy as to ranching herds.

Sheep.—Sheep are best kept on the high veld for a while longer. If grass seeds are troublesome, a grazing area should be mown. If the rams were put into the flock in May, they should now be removed. Ewes with lambs will benefit by a few handfuls of mealies, and perhaps ensilage. They should be provided with shelter from cold winds.

TOBACCO.

The grading of tobacco should be proceeded with. Any bales stored on the farm should be turned occasionally, especially where more than one bale is placed on another. Arrangements for the grading of tobacco seed should be made for the coming season. Growers purchasing tobacco seed should place orders early with distributors of reliable seed.

VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. Inoculation can be carried out now. Scab is a poverty winter disease.

WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

July.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry out repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad;

these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

DECIDUOUS FRUITS.

Pruning must be continued. and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects; or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous. Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inch over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

Southern Rhodesia Veterinary Report.

March, 1931.

TRYPANOSOMIASIS.

This disease is becoming more prevalent on the eastern border of Melsetter district, where thirty-two cases were recorded; two cases at Wankie and one at Gatooma.

HORSE-SICKNESS.

Deaths reported in the following districts: Charter, 13; Bubi, 2; Umzingwane, 1; Matobo, 3; Mazoe, 1; and Hartley, 3.

ANAPLASMOSIS AND PIROPLASMOSIS.

A considerable amount of infection has occurred in various districts, with quite a few deaths in some herds.

SWEATING SICKNESS IN CALVES.

Numerous cases of this disease have been reported.

CUTANEOUS MYIASIS (SCREW WORM IN CATTLE).

Prevalent in a few districts.

IMPORTATIONS.

From the Union of South Africa: Horses, 7; donkeys, 82; sheep, 1,922; goats, 445.

EXPORTATIONS (CATTLE).

To the United Kingdom: 400. To the Union of South Africa: For local consumption, 169; for export overseas, 1,425. To Belgian Congo: Slaughter, 864. To Northern Rhodesia: Slaughter, 279; breeding, 94. To Portuguese East Africa: Breeding, 10.

EXPORTATIONS (MISCELLANEOUS).

To Union of South Africa: Pigs, 14. To Belgian Congo: Sheep, 107; pigs, 400. To Northern Rhodesia:

Sheep, 235; goats, 17; pigs, 177. To Portuguese East Africa: Sheep, 40; goats, 20.

EXPORTATION IN COLD STORAGE.

Carcases: Beef, 137½; veal, 11; sheep, 37; pigs, 10; livers, 190; tongues, 100; hearts, 540; brains, 40; tails, 94; tripes, 200; kidneys, 20.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

APRIL, 1931.

Pressure.—The barometric pressure was above normal over the whole country.

Temperature.—Summer conditions continued up to the 20th, when a cold spell intervened. This was soon replaced by a further warm spell, which extended over the end of the month.

Rain Periods.—Light showers were fairly general on the 1st, and isolated showers continued to the 8th. On the 9th scattered showers were recorded, and from the 10th to the 13th showers fell in the south-west. Isolated showers continued to the 23rd, when a fine spell started and lasted to the 29th. A few showers were reported on the 29th.

Rain.—The rainfall recorded amounted to 1.4 inches, bringing the seasonal total to 23.4 inches, approximately 4 inches below normal.

The rain was distributed as follows:—

	Rainfall, April, 1931.	Normal April.
Zone A	1.6	0.8
Zone B	1.5	0.8
Zone C	1.0	1.0
Zone D	1.5	1.1
Zone E	1.2	1.1
Zone F	2.4	2.7

APRIL, 1931.

Station.	Altitude	Pressure 8 a.m.	Temperature ° F.						Humidity, 8 a.m.		Precipitation.		
			Absolute.		Mean.			Diff. from Normal.	Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min						
Bulawayo ...	4,440	870.7	90.0	45.0	79.3	55.9	67.6	+1.6	58.6	66	.3	− .07	3
Gwelo	4,632	864.9	86.0	42.0	77.3	55.4	66.3	+1.1	58.2	70	1.7	+1.4	6
Riverbank ...	4,100	...	95.0	40.0	83.9	56.7	70.3	+2.4	60.2	67	.8	+ .1	7
Essexvale ...	3,828	...	94.0	39.0	83.8	56.1	69.9	+3.0	59.2	83	1.7	+1.2	6
Gwanda ...	3,235	909.6	94.0	39.0	80.6	56.3	68.4	...	60.3	66	2.1	+1.8	6
Mazunga ...	1,970	951.2	98.0	43.0	82.8	57.9	70.3	−2.4	64.2	71	1.0	+ .5	4
Nuanetsi ...	1,630	...	99.0	43.0	87.5	57.8	72.6	...	63.5	72	.8	...	6
Between Rivers	3,970	...	...	...	...	...	...	...	...	...	...	...	...
Enkeldoorn ...	4,720	...	...	...	...	54.6	...	...	59.3	70	.7	+ .4	3
Gatooma ...	3,850	...	90.0	44.0	83.7	56.1	69.9	+0.4	60.5	63	.1	− .24	3
Miami	4,090	...	85.0	48.0	78.2	58.1	66.6	...	61.9	75	.4	...	3
Salisbury ...	4,865	857.1	86.0	45.0	77.6	55.9	66.7	+0.9	58.3	67	.5	+ .15	4
Sinoia Citrus ...	3,830	...	87.0	41.0	79.1	54.1	66.6	...	59.0	74	1.3	+1.1	3
Sipolilo... ...	3,900	...	87.0	48.0	77.3	59.4	68.3	...	61.8	67	.5	Normal	4
Juliasdale ...	6,070	...	79.0	39.0	70.4	50.0	60.2	+1.1	56.3	68	1.9	+1.0	8
Mtoko	4,210	...	85.0	48.0	78.4	58.0	68.2	...	62.5	75	2.1	+1.7	3
Shamva ...	3,170	...	...	...	...	...	...	...	...	...	...	...	...
Angus Ranch ...	2,300	...	93.0	50.0	84.9	63.3	74.1	...	64.4	70	1.04	+ .9	6
Craigendoran ...	3,000	...	90.0	50.0	82.0	57.0	69.5	...	64.4	73	1.3	+ .9	6
New Year's Gift	2,700	...	89.0	51.0	80.5	58.9	69.7	...	61.9	75	1.9	...	10
Nyamasanga ...	5,080	...	82.0	41.0	74.1	50.9	62.5	...	57.7	65	2.6	...	8
Riverdene North	3,700	...	90.0	37.0	82.0	53.5	67.9	+2.4	59.6	78	.4	+ .03	6
Stapleford ...	5,450	...	76.0	35.0	68.3	49.7	59.0	...	56.4	77	3.9	+2.6	10
Umtali	3,677	895.3	88.0	46.0	77.1	57.8	67.4	−0.4	62.2	72	1.7	+1.2	6
Victoria ...	3,570	898.4	90.0	40.0	78.7	55.9	67.3	+2.0	60.8	68	.2	− .17	5
Melsetter ...	5,060	852.4	81.0	45.0	72.5	54.3	63.4	+1.2	57.3	66	2.4	+1.4	11
Mount Silinda...	3,520	...	81.0	47.0	74.1	58.4	65.1	+0.2	63.1	80	2.2	+ .6	12

Export of Cattle from Southern Rhodesia, 1931.

Month	Union		England.	Congo		N. Rhodesia.		Portuguese East Africa.		Total
	Slaughter		Slaughter							
	Union of S.A.	I.C.S. for overseas	On hoof	Slaughter	Breeding	Slaughter	Breeding	Slaughter	Breeding	
January ...	120	...	...	1,381	1,383	626	267	..	...	3,777
February ...	127	634	170	1,974	62	546	14	...	...	3,527
March ...	169	1,425	400	864	...	279	94	...	10	3,241
April ...	...	...	...	108	...	36	235	...	...	379
May ...										
June ...										
July ...										
August ...										
September ...										
October ...										
November ...										
December ...										

Notes from the "Gazette."

"*Gazette*" *Date.*	*Items.*
	AFRICAN COAST FEVER.
8.5.31.	Government Notice No. 298 defines the following area of infection and guard area :—

NATIVE DISTRICT OF SALISBURY.

(a) *Area of Infection.*

The farms Cleveland, Lorelei, Rodia, Green Grove, Green Grove A (including Tony Croft), Bingley, Cavan, Doon, Letombo, Amby and Makabusi A.

(b) *Guard Area.*

An area bounded by and including the following farms : St. Mary's, Eyrecourt, Spreckley, Waterfall and its subdivisions, Ardbennie, Salisbury Commonage, Avondale (excluding Greasley and Rocky Lodge), Mount Pleasant, Tudely, Pendennis, Outspan, Pomona, Pomona E, Lots 16 and 17, C, D and G Borrowdale Estate, Guildford, Glen Forest, Georgic; thence along the southern boundaries of the Chindamora and Msana Reserves, the western boundaries of the Chikwakwa and Kunzwi Reserves to the north-western beacon of Middlesex Farm; thence by and including Crown lands south of Kunzwi Reserve and the farms Ngargwi, Windsor, Datata, Forres, Nyambuya, Waterford, Weardale A and B, Southampton, Musi and Hedon; thence along the southern boundary of the Seki Reserve until this joins the south-western beacon of the farm St. Mary's.

"GAME AND FISH PRESERVATION ACT, 1929."

15.5.31. The following area has been proclaimed a game reserve, wherein it is not lawful to hunt game without the special permission in writing of the Minister of Agriculture and Lands :—

Those portions of the Gwanda and Chibi native districts which lie within twenty-five miles of the Limpopo River, and those portions of the said districts, above twenty-five miles from the Limpopo River, lying to the east of the Beitbridge-Fort Victoria main road. (G.N. No. 13.)

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only. Outside Southern Rhodesia, 3d. per copy.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 581. Leguminous Crops for Stock and Soil Improvement in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 603. The Production of Maize in Southern Rhódesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 724. Ploughing by Tractor, by A. W. V. Crawley, M.E., F.G.S.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 750. Cotton in Southern Rhodesia—Hints to Growers, by G. S. Cameron, Empire Cotton Growing Corporation.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld : Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

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Selecting Birds for Laying Tests, by A. Little, Poultry Expert.
Cold Weather: Treatment of Fowls in, by A. Little, Poultry Expert.
Tuberculosis, by A. Little, Poultry Expert.
Diseases of the Liver, by A. Little, Poultry Expert.
Prevention of Disease among Poultry, by A. Little, Poultry Expert.
Vices: Causes, Prevention and Cure, by A. Little, Poultry Expert.
Chicken-pox (Warts), by A. Little, Poultry Expert.
Autopsies, by A. Little, Poultry Expert.
Autopsies (continued), by A. Little, Poultry Expert.
Preparing Birds for Show, by A. Little, Poultry Expert.
Coccidiosis, or Entero-Hepatitis, by A. Little, Poultry Expert.
The Fowl Tick (Argas persicus), by A. Little, Poultry Expert.
Worms (Autopsies—continued), by A. Little, Poultry Expert.
Selecting Birds for Laying Tests (concluded), by A. Little, Poultry Expert.
Culling: A Seasonal Operation, by A. Little, Poultry Expert.
Despatching Birds to a Laying Test, by A. Little, Poultry Expert.
Choosing a Male Bird, by A. Little, Poultry Expert.
The Breeding Stock, by A. Little, Poultry Expert.
Diseases of the Digestive System, by A. Little, Poultry Expert.
Bone and Breast Bone, by A. Little, Poultry Expert.
Mating for Improvement and Increased Egg Production, by A. Little, Poultry Expert.
Partial Moult: Broodiness: Selection of Layers of Large Eggs, by A. Little, Poultry Expert.
Sunflower as a Food, by A. Little, Poultry Expert.
Grow Sunflowers, by A. Little, Poultry Expert.
Exhibiting Eggs at Shows, by A. Little, Poultry Expert.
Condition of Birds on Show, by A. Little, Poultry Expert.
Green Food: The Result of not Supplying Sufficient to Poultry, by A. Little, Poultry Expert.
Good and Bad Hatching Eggs, by A. Little, Poultry Expert.
Grading Fowls, by A. Little, Poultry Expert.
Heart Trouble, by A. Little, Poultry Expert.
What are You Feeding for? by A. Little, Poultry Expert.
Housing: Three Important Essentials, by A. Little, Poultry Expert.
Menu at the Egg-Laying Test.
Advice to Prospective Poultry Farmers, by A. Little, Poultry Expert.
Seasonal Hints—August, by A. Little, Poultry Expert.
Successful Chick Rearing, by H. G. Wheeldon, Assistant Poultry Expert.
Hints to Breeders, October, by A. Little, Poultry Expert.
Abnormalities in Eggs, by A. Little, Poultry Expert.
Diseases of the Reproductive System, by A. Little, Poultry Expert.
Notes for November, by A. Little, Poultry Expert.
Hints to Breeders. Prepare for the Breeding Season, by A. Little.
Respiratory Diseases, by A. Little, Poultry Expert.
Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.
The Close of the Hatching Season and After, by H. G. Wheeldon, Poultry Expert.

METEOROLOGICAL.

No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 542. Review of the Abnormal Rainfall Season 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 712. The Time, and How to Find it, by N. P. Sellick, M.C., B.Sc. (Eng.).

MISCELLANEOUS.

No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by A. G. Holborow, F.I.C.
No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
No. 479. Quinine Prophylaxis in Malaria, by A. M. Fleming, M.B., C.M., F.R.C.S.E., D.P.H.
No. 518. Locusts as Food for Stock, by Rupert W. Jack, F.E.S.
No. 549. Ochna Pulchra Berries, by A. W. Facer, B.A., A.I.C.
No. 554. Pisé-de-Terre, by P. B. Aird.
No. 569. Education of Children of Farmers in Southern Rhodesia, by R. McIntosh, M.A.
No. 574. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
No. 588. Concrete on the Farm, by N. P. Sellick, M.C., B.Sc. (Eng.), Assistant Irrigation Engineer.
No. 652. Farm Homesteads, by R. H. Roberts, B.Sc. (Eng.).
No. 677. Road Motor Services.
No. 680. Preparation of Cotton for Sale, by H. C. Jefferys.
No. 686. The Land Bank, Its Functions and How it Operates, by S. Thornton.
No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).
No. 699. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor General.
No. 702. Book-Keeping on the Farm, by T. J. Needham, Acting Accountant, Agricultural and Veterinary Departments.
No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.
No. 733. Jam-making, by Miss D. Bosman, Home Economics Officer, Division of Agricultural Education and Extension, in "Farming in South Africa."
No. 764. How to Make Use of the Fencing Law.

Farming Returns for Income Tax Purposes.

Land Bank Act (price 1/-).

Twelve Simple Rules for the Avoidance of Malaria and Blackwater.

Summary of the Game Laws of Southern Rhodesia

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Southern Rhodesia's occupation of the Empire Marketing Board's shop in High Street, Birmingham. The High Commissioner (Hon. J. W. Downie) presents the Lord Mayor (Alderman W. W. Saunders) with a handsome casket containing samples of Rhodesian tobacco and cigarettes.
(By courtesy of Bulawayo Chronicle.)

THE RHODESIA

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Editor - - *William E. Meade.*

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Advertising Southern Rhodesia.—The Colony received good publicity by its occupancy of the Empire Marketing Board's shop at Birmingham for the period 4th to 16th May. This shop, which is placed at the disposal of the Dominions and Colonies for the purpose of exhibiting and selling samples of their products, is situated in a popular and busy thoroughfare and is a source of constant interest to the inhabitants of this populous city. Tobacco was the main feature of Southern Rhodesia's display and some 2,156 lbs. of different types of leaf in addition to a number of brands manufactured wholly or partly from Rhodesian tobacco were used for the purpose. The exhibition was opened by the High Commissioner, Hon. J. W. Downie, in the presence of the Lord Mayor of Birmingham, and the shop was subsequently visited by a large number of residents. The manner in which

the samples were displayed was the subject of much favourable comment and no opportunity was lost of convincing visitors of the merits of Rhodesian produce and tobacco in particular. It is interesting to note from a report furnished by the High Commissioner's office in London that arrangements were made with forty-five retail tobacconists to make special shop window displays of Rhodesian tobacco and that a number of firms have promised to continue their co-operation in popularising our product.

Work of this kind is bound to produce results and, provided the type of leaf is suitable and supplies are maintained, there is good reason for believing that Rhodesian tobacco will wean an increasing number of British smokers to its use.

The World's Trade in Maize.—The International Review of Agriculture, issued in Rome, publishes the following figures of the exports and imports of maize in centals of 100 lbs. during the period 1st November, 1929, to 31st October, 1930—Exports: Bulgaria, 4,017,000; Hungary, 3,351,000; Rumania, 28,424,000; Yugoslavia, 12,013,000; U.S.A., 4,303,000; Argentine, 96,331,000; Indo-China, 2,339,000; Union of South Africa, 12,267,000. Imports: Germany, 16,506,000; Austria, 4,312,000; Belgium, 12,908,000; Denmark, 6,250,000; Spain, 3,840,000; Irish Free State, 8,047,000; France, 17,357,000; Great Britain and N. Ireland, 36,306,000; Italy, 15,252,000; Netherlands, 23,177,000; Czechoslovakia, 7,573,000.

Agricultural Economics.—We regret to state that in consequence of the recall of Mr. J. R. McLoughlin, Economic Adviser, to the service of the Union of South Africa, it will be impossible for him to complete the series of articles which he commenced in the May issue of this Journal. This is very unfortunate, for the two articles which have appeared created a good deal of interest and focussed attention on a subject of the utmost importance to the agriculturist in this Colony. It is clear that the old haphazard methods of indiscriminate production and unorganised marketing must go.

Agriculture to-day is struggling for existence in competition with entrenched interests organised to meet changing conditions, and unless the industry revises its methods and falls into line it will be at the mercy of every economic blast that comes along.

There is urgent need in this Colony for deep study of these problems, and we trust that what has been written will stimulate and direct thought into the channel leading to practical effort.

Foot and Mouth Disease.—Since the 18th May, when the last reference to this subject was made in the Journal, the spread of the disease has been slow, and there is no evidence to indicate that it has been conveyed by any other means than the actual contact of cattle. In view of this favourable condition guards are being placed around infected areas to keep infected cattle strictly within the limits of their farms and to keep clean cattle away from those borders, thus endeavouring to form small cattle-free areas round each zone of infection. It is hoped in this way to keep the disease approximately within the present limits in anticipation that the virus will die out during the dry season.

The severity of the embargo imposed by surrounding States has been to some extent modified. It is now possible to send butter, subject to certain restrictions, both to Northern Rhodesia and the Congo, and it is hoped that the export of frozen meat and of at least some agricultural products will be possible at an early date.

The situation as far as the disease is concerned is reassuring, but the Government is endeavouring to obtain the services of a recognised authority from Great Britain to advise on methods of control and necessary restrictions resulting from the presence of the disease in the Colony.

Ploughing Under Sunn Hemp.—The photograph on the opposite page is reproduced as an item of interest. It was sent to us by Mr. W. A. v. Fetter, of Farm Vale do Algarve,

Vilà Pery, and shows the method employed by him of treating a sunn hemp crop prior to ploughing it under as green manure. It will be seen that a roller is employed for the purpose of flattening the crop and that it is followed by a disc harrow which cuts the growth. Mr. Fetter states that no difficulty was then experienced in ploughing the sunn hemp under. He considers that the roller alone drawn by six oxen without the disc harrow would have given almost as good results. He states that he is at the present time employing the method illustrated for the purpose of flattening grass eight to nine feet high on a piece of land required for cultivation.

We have shown the photograph to the Chief, Division of Plant Industry, who comments as follows:—

"Your correspondent's suggestions for rolling a green manure crop before ploughing it under are not altogether new, and such a course may be advisable when the growth is extremely rank. Given a normal development of the legume, rolling is not as a rule necessary, particularly in the case of sunn hemp and when a tractor is employed to draw the plough.

"It is often of distinct advantage to follow the plough with a weighted disc harrow or roller as this assists in closing the furrows, while it fills in the air spaces and checks loss of moisture from the soil—thus hastening the decomposition of the green manure crop."

Great Britain's Citrus Imports.—The growing popularity of the orange with the British public is demonstrated by figures which have recently been issued by the Empire Marketing Board in a publication entitled "Fruit Supplies in 1930." During the four years from 1925 to 1928 imports of oranges into the United Kingdom showed little variation, the total being consistently between 7,700,000 cwts. and 8,000,000 cwts. The year 1929, however, showed a sharp rise to a total of 9,264,000 cwts. and last year a further substantial rise brought the total imports to 10,211,000 cwts. —the first year in which imports have exceeded 10 million cwts. Imports last year exceeded by over 30 per cent. the

Flattening and harrowing sunn hemp at Vila Pery before ploughing it under as green manure.

average imports for the four years 1925-28, giving clear proof of the recent striking increase in orange consumption. Spain is easily the largest supplier of oranges to Great Britain, and contributions from that country in 1930 amounted to 7,206,000 cwts. Palestine is next in order with 1,320,000 cwts., followed by South Africa with 1,100,000 cwts. Figures are not given of Southern Rhodesia's contribution and we presume it is included in the total for South Africa. Supplies from the United States of America have fluctuated considerably during the past few years, ranging from 28,000 cwts. in 1925 to 979,000 cwts. in 1929 and dropping to 38,000 cwts. in 1930. Brazil entered the British market in 1927 with 19,000 cwts., which increased to 86,000 cwts. in 1928, 250,000 cwts. in 1929 and 356,000 cwts. in 1930. Of the total quantity of oranges imported into the United Kingdom in 1930, 7,786,000 cwts. came from foreign countries and 2,425,000 cwts. from Empire countries.

Imports of grape fruit into Great Britain have shown a phenomenal increase during the past decade. In 1921, total imports amounted to no more than 21,449 cwts.; in the following three years they totalled 31,600 cwts., 50,149 cwts., and 81,367 cwts. respectively, while in 1930 they totalled no less than 556,791 cwts. The great bulk of the grape fruit imported into the United Kingdom comes from the United States, shipments from thence in 1930 amounting to 393,321 cwts. South Africa comes next in order of priority with 46,813 cwts., followed by Cuba with 36,917 cwts. Of the total imports 468,888 cwts. came from foreign countries and 87,903 cwts. from Empire countries. Most of the United States grape fruit shipped to the United Kingdom is grown in Florida, where the harvesting season starts about September and continues to May, with peak supplies about March or April.

It is interesting to note that the United Kingdom in 1930 imported 1,477,000 cwts. of lemons of which 1;076,000 cwts. came from Italy and 301,000 cwts. from Spain.

Empire Cotton.—The subject of Empire Cotton was discussed at the Imperial Economic Conference held in London

in October last, and the following is an extract from the Summary of Proceedings:—

"The General Economic Committee discussed the question of cotton growing within the Empire with representatives of the Empire Cotton Growing Corporation. There has been a marked increase in the growth of cotton in the Empire in the last ten years, and there has also been a distinct falling-off in the consumption in the United Kingdom of United States cotton as compared with cotton of other growths. Much expansion of cotton growing in the Empire is, however, not to be expected unless prices improve.

"On the recommendation of the General Economic Committee, the Conference adopted the following resolution:—

> " 'The Conference notes with satisfaction the increased production of cotton within the British Commonwealth of Nations in recent years and recommends to the consideration of the Governments of the various parts of the Empire concerned that they should take all possible steps to maintain that increase, in particular (a) by requiring a sound and scientific foundation in the training and qualifications of their agricultural officers, and (b) by pursuing an agricultural policy which recognises that cotton growing can only be established as a permanent feature of the agriculture of any country if it constitutes one crop in an evenly balanced rotation suited to local climatic conditions.' "

We see from the last annual report of the British Cotton Growing Association that there was a very considerable reduction in the Spot sales of American cotton in Liverpool during the twelve months ended 31st July, 1930, the total being 665,100 bales, as compared with 996,770 bales for the year ended 31st July, 1929, showing a decrease of over 33 per cent. On the other hand the Spot sales of Empire and other outside growths of cotton during the same period increased by more than 20 per cent. from 569,970 bales to 686,080 bales. For the first time the sales of American cotton were exceeded by those of other varieties of cotton. The British Cotton Growing Association regard the increase in the consumption of Empire and miscellaneous growths as most gratifying, and proof that the cotton is superior in quality and value compared with American.

The following reference to Southern Rhodesia appears in the report:—

"Information is now taking more definite shape in regard to improvements in cultural methods, particularly spacing, and the employment of a much heavier seed rate in order to secure good stands of plants. More time and effort is being put into the Bollworm investigation, and there are indications that the ravages of this pest may be countered at least to a significant extent. There is no doubt that the cotton-growing industry has made a considerable advance in the year under review, and a gradual expansion of the industry may confidently be expected, as the result of the work of the expert staff of the Empire Cotton Growing Corporation."

Imperial Co-operation in Agricultural Science.—In the Estimates of Expenditure for the current financial year will be found an item "Imperial Agricultural Research Bureaux, £250," and it may be well to explain for what purpose this grant is made. At the Imperial Agricultural Conference in 1927, at which this Colony was represented, the need of agricultural investigators throughout the Empire for the systematic supply of scientific information bearing on research was strongly emphasised. As a result, a scheme of Imperial Agricultural Bureaux was drawn up and arrangements made for it to be financed partly by the British Government and partly by each of the countries of the Empire. Eight Bureaux are now in working order and are controlled by an executive committee on which each country is represented. In order that research workers abroad might obtain the utmost possible assistance and that research institutions in England might be brought into touch with the needs of other portions of the Empire, each bureau was located at a centre of research in the special subject dealt with. Thus the Imperial Bureau of Soil Science has been placed at the famous Rothamsted Experiment Station. The Imperial Bureau of Plant Genetics (for crops other than herbage) has been placed at Cambridge and associated with the School of Agriculture, whilst the Imperial Bureau of Plant Genetics for herbage plants has been placed at

Aberystwyth, where so much valuable work on fodder crops and grasses has already been conducted. The Imperial Bureau of Fruit Production is situated at the East Malling Fruit Research Institute in Kent. The Imperial Bureau of Animal Nutrition is located at the well-known Rowett Institute at Aberdeen, that of Animal Health at the Veterinary Laboratory, Weybridge, that of Animal Genetics in the University of Edinburgh, whilst the Imperial Bureau of Agricultural Parasitology has found a home at St. Albans. It will be observed that these Bureaux, together with the older institutions—the Imperial Bureau of Mycology at Kew and the Imperial Bureau of Entomology, now the Imperial Institute of Entomology—cover most branches of agricultural science. Their functions are to collect, collate, abstract and distribute to all research workers desiring such assistance, the results of recent research in the subject with which the Bureau deals. Already several valuable bibliographies and summaries of current research in several subjects have recently been issued. The Bureaux have a still more important, if less definite, function than the publication of bibliographies and abstracts, viz., to assist individual research workers to obtain information as to how matters stand in any particular branch of investigation and to put them in touch with specialists in other countries. The Bureaux have skilled translators and are thus able to make available papers which are not easily accessible.

The work of the Bureaux is essentially co-operative. In each country there is an official correspondent for each bureau and it must be remembered that only in so far as other countries in the Empire provide the Bureaux with copies of published papers and other information, can the Bureaux maintain the supply of information to workers in other parts of the Empire.

Agriculture in Nyasaland.—The report of the Director of Nyasaland for the year 1930, recently to hand, records the fact that the past year has been a difficult one for all producers. Prices have continued to fall and production of certain crops, it is stated, has been distinctly unremunerative.

The report mentions that the general depression has held up much agricultural development that is waiting to be taken in hand, and the opinion is expressed that although this has done good in directing increased attention to the necessity for the highest quality in the products of the country, at the same time it has prohibited the adoption of lines of work which would lead to improvement in quality.

The principal crops grown by Europeans in Nyasaland are tobacco, cotton, coffee, sisal, rubber and tea, and figures of the acreages planted to these crops show a reduction in the first three and an increase in the others. Thus, 17,481 acres of tobacco were planted in 1930, as compared with 19,269 in 1929; cotton, 761 acres in 1930 and 1,219 in 1929; coffee, 1,256 acres in 1930 and 1,331 in 1929; sisal, 9,296 acres in 1930 and 8,270 in 1929; rubber, 1,405 acres in 1930 and 1,330 in 1929; tea, 9,686 acres in 1930 and 8,866 in 1929. The acreage planted with miscellaneous crops was 15,373 in 1930 and 19,892 in 1929. Tobacco is grown on a considerable scale by natives in Nyasaland, and production from this source in 1930 amounted to 4,233 tons, representing an increase of 352 tons over 1929. The number of registered native tobacco growers in 1930 was 48,419 against 47,578 in 1929.

The Empire Cotton Growing Corporation is carrying on in Nyasaland its good work of endeavouring to make the Empire independent of foreign cotton and promising results are recorded with strains of the U.4 variety. Although the production of European grown cotton shows a material reduction as compared with 1929, that grown by natives increased by 55 per cent., amounting to 5,448 tons of seed cotton against 3,505 tons in 1929.

Tea growing in Nyasaland is entirely in the hands of European agriculturists. The acreage increased from 8,866 in 1929 to 9,686 in 1930 and production from 778 to 850 tons. Prices paid for the product were low and it is felt that apart from the present depression, there is need to raise the quality of Nyasaland tea. Measures proposed to attain this end are the growing of shade trees and green manures and improvement in the various factory processes from withering to firing and grading. There has been a general adoption of ridge terracing as a measure of soil conservation and it is estimated that 85 per cent. of the tea land

of the Protectorate has been so treated. It is proposed to institute a Tea Experimental Station in the Mlanje district under the auspices of the Department of Agriculture. It is interesting to note that it is hoped to establish before long experimental coffee plots in different districts on which there will be investigated shade, green manuring, ground cover plants, methods of conservation of soil and soil moisture, pruning systems and control of pests. We observe from the report of the mycologist that leaf rust (*Hemileia vastatrix*) has been discovered in coffee growing in Nyasaland and that the disease has been present in the past, although it was not reported to the Department.

Perusal of the report shows that a great deal of valuable work is being done in the Protectorate to advance the cause of agriculture and that there is much similarity in the problems which beset the agriculturists in the north and in this Colony.

Departmental Bulletins.—In consequence of the necessity for reducing the cost of producing the Journal, it has been decided to make a charge of 3d. per copy for all bulletins supplied, whether applicants are resident in Southern Rhodesia or outside.

It should be noted that remittances must accompany all orders for bulletins, a list of which is printed towards the end of each issue of the Journal.

ERRATUM.

Page 530, line 18, *Rhodesia Agricultural Journal*, June, 1931, read "maintained" instead of "manufactured."

Pasture Research in Southern Rhodesia.

FARMERS' DAY AT MARANDELLAS.

By The Editor.

About twenty farmers and a number of officials accepted the invitation of the Department of Agriculture to visit the Government Sand Veld Farm at Marandellas on the 5th June to inspect the pasture research work in progress. This work, it should be explained, is being undertaken by means of a grant from the Empire Marketing Board, to which a corresponding amount is added by the Government of this Colony and is to extend over a period of three years from 1931. As most readers of the Journal are aware similar work is in progress in various parts of the Empire.

Dr. Brain, on behalf of the Department of Agriculture, welcomed the visitors to the station, and explained that the station was started about 15 months ago in response to a feeling which had been in existence for many years that something was needed to demonstrate the possibilities of the ordinary granite sand. A number of proposals were considered before it was decided to accept the present site which was typical of the poorer sand veld areas of the Colony. He explained that the farm, which was 3,220 acres in extent, was divided into four sections, one consisting of (a) a demonstration sand veld farm, (b) a tobacco research station, (c) a pasture land research section and (d) a crop experiment station. He mentioned that there was another section of pasture work in progress at Matopo on black vlei soil. He felt convinced that visitors would see a great deal to interest

them in the experiments now being conducted and hoped they would have a pleasant and instructive day.

Miss Stent, Pasture Research Botanist, gave a short address explaining how grasses of high and low feeding value could be distinguished. When she came to the Colony about a year ago she went over the station before it had been stumped and a poorer proposition could not have been seen from a botanical point of view. It looked, she said, as though there was no food for cattle at all. She visited the Station again last December, and, though the different time of year must be taken into consideration, it was almost unbelievable to note the change that had taken place. Stumping, fertilising and grazing had apparently had the effect of encouraging the better grasses and instead of sparse grass there was a mass of succulent sweet herbage.

Miss Stent proceeded to give a general idea of how to discriminate between the poorer and better types of grasses. She explained that on the whole the grasses in Africa with long awns or "beards" were poor. There were exceptions, of course, but it might be taken as a general rule that grasses without the long awn had a higher feeding value than those with awns. She instanced the various thatching grasses and assegai" grass as examples of the awned grasses, and Guinea grass, Paspalum and the Finger grasses as examples of the better unawned type.

It has been found that nearly all grasses that had their spikelets or "seed" tightly packed on one side of the axis, like Paspalum and the Finger grasses, were very nutritious.

The Finger grasses were especially valuable. These have flower heads composed of rather long, very slender spikes borne at the top of the flower stem and are known botanically as *Digitarias*. There are many species of *Digitaria* in Southern Rhodesia, but she had not yet found the Woolly Finger grass in Mashonaland although she had seen it in Matabeleland. Miss Stent concluded by saying that as a general rule it could be accepted that the stoloniferous grasses, that is those that send out long surface runners that root at the joints, were better for pasture than the bunch types. The former covered the ground better, choked out weeds, conserved moisture and provided good grazing.

Farmers' Day at Pasture Research Station, Marandellas. 5th June. 1931.

Cattle on the N.P.K. Paddocks at the Pasture Research Station. 5th June, 1931.

Showing herbage in the unstumped control paddock, Pasture Research Station, Marandellas.

Mr. Ll. E. W. Bevan, Director of Veterinary Research, gave a short address in the course of which he emphasised the importance of sound nutrition in the health of farm animals and in resistance to disease. He referred particularly to the sheep industry and expressed the opinion that under-nourishment was a condition precedent to the incidence of disease.

Mr. Husband, Chief Chemist, who is in charge of pasture research, then addressed the meeting and confined his remarks to the plan of experiments, the work in progress and the trend of the results so far obtained. He explained that the work at Marandellas is proceeding on the lines of paddocking, plus fertilising and rotational grazing of the natural pastures. He showed that there are 24 paddocks of 20 acres each, divided into groups of six paddocks. Thus, each one of the six paddocks is replicated four times. The treatment accorded the paddocks is as follows:—

One group receives 200 lbs. per acre of superphosphate, 100 lbs. per acre of muriate of potash and 100 lbs. per acre of sulphate of ammonia. *This is the N.P.K. group.*

One group receives 200 lbs. per acre of superphosphate and 100 lbs. per acre of muriate of potash. *This is the P.K. group.*

One group of paddocks receives 200 lbs. per acre of rock phosphate. *This is the R.P. group.*

One group of paddocks receives 200 lbs. per acre of superphosphate. *This is the Super group.*

One group of paddocks receives no fertiliser, but the grass is cut and grazed. *This is the Control group.*

One group of paddocks is left in its natural state; it is unstumped, receives no fertiliser and the grass is grazed but not cut. *This is the Unstumped Control group.* All other paddocks have been stumped.

Mr. Husband further informed his audience that each group of paddocks has nine head of cattle allotted to it, four tollies and five heifers, the animals being as near as can be of similar type and age. Each group of nine cattle rotate through their four paddocks and were placed therein on the 28th January last. The grass in the paddocks was cut between the 10th February and the end of that month and

stacked in the paddocks to be consumed as desired. The weight of the cattle on the 22nd January and 27th May was shown by a graph to be as follows:—

Paddock.	Weight 22nd January.	Weight 27th May.
N.P.K.	5,730 lbs.	6,390 lbs.
P.K.	5,770 lbs.	6,420 lbs.
R.P.	5,790 lbs.	6,470 lbs.
Super	5,720 lbs.	6,310 lbs.
Control	5,730 lbs.	6,310 lbs.
Unstumped Control ...	5,810 lbs.	5,790 lbs.

It was thus seen that during the period of four months the cattle in the unstumped control paddocks actually lost weight, whereas in all the others, even in the unfertilised paddocks, they gained materially in weight. The explanation of this is found by reference to the chemical analysis of the grasses in the various plots and demonstrated to the visitors by means of a graph. Briefly, it can be stated that the protein contein of the grasses in all groups of paddocks averaged at the start of the experiment between 5.5 per cent. and 6.5 per cent. This figure dropped in February to about 5 per cent. After the grass was cut it rose to between 6 and 6.5 per cent. in March and continued to rise until April when it reached a figure as high as 9 per cent. in the *N.P.K.* paddocks. In the *Unstumped Control* paddocks there was a steady fall from the initial figure to 2.6 per cent. on the 12th April. In the *Control* group the protein content on the latter date was 6.6 per cent.

The analysis of the mineral content of the grasses followed somewhat similar curves.

Mr. Husband put the matter in a nutshell by explaining that each beast has approximately 9 acres of grass or hay to feed on as against 20 acres when the farm was formerly used for ranching purposes.

He explained that a very thorough botanical analysis of the pastures is being made to ascertain the effect of the various treatment on the botanical composition of the pastures. Quadrates one yard square are laid down in each paddock in areas that were considered most representative of the paddock as a whole, and the name and number of each species of plants occurring in each quadrate before treatment

was recorded. These quadrates then received the same treatment as the rest of the paddock and observations are made from time to time to determine what, if any, change has taken place in the vegetation. It was found that beyond a greater luxuriance of growth no change has so far taken place. The effect of the treatment on the actual composition of the vegetation cannot be expected to be manifest before at least two seasons.

Mr. Husband was listened to with the greatest attention, and it was obvious that his clear exposition of the work in progress had stimulated the desire of the visitors to see for themselves the results so far obtained.

An adjournment was made for lunch, after which a systematic inspection was made of the various paddocks and the cattle therein. It was explained that the latter were back in the paddocks they commenced the experiment with in January last. Visitors agreed that with the exception of the animals on the *Unstumped Control* paddocks the cattle were in particularly good condition. Those in the *N.P.K.* paddocks were in fine bloom and showed every sign of boisterous health. It will be interesting to see how the cattle carry their condition during the winter months, for the Marandellas station is exposed to cold searching winds at this time of the year. It is, of course, too early to form any conclusions as to the trend of the experiments, but the results so far are certainly very striking. As already stated work is to continue over a period of three years, and there is no doubt that by then farmers of this Colony will be in possession of valuable data regarding the treatment of our natural pastures and the results that may be expected therefrom.

A hearty vote of thanks proposed by Mr. H. B. Christian and cordially endorsed by the visitors, terminated a very interesting and educative day.

The Woodland Types of Southern Rhodesia.

By J. S. Henkel, late Chief Forest Officer.

General.—The Colony is comparatively well wooded, being covered more or less with trees and shrubs over about 60 per cent. of the entire area. The great age of the Rhodesian plateau, together with its geographical position, physical features and summer rainfall, has resulted in many striking features in the vegetative covering. Until careful botanical surveys have been made it is difficult to distinguish and classify types in what appears, at first sight, an extraordinary mixture of trees, shrubs, grasses and herbaceous plants. In a general way, however, the vegetation consists of woodland and grassland. The woodland may have its trees large or small, widely spaced or closely spaced. This woodland is found in two groups or types:—First, the *closed forest*, and, second, the *open forest* or *tree-veld*. In the former the trees are always crowded, usually evergreen, produce dense shade and have no grass undergrowth or such a small quantity as not to form a feature. By the latter is understood a mixture of trees and grass—grass is always associated with the type. In many places there is no clear or distinct line separating woodland from grassland. The woodlands sometimes end abruptly; in other instances they thin out gradually with clumps, often on termite mounds, closely or widely spaced or as single trees here and there, and when these disappear open grassland dominates.

With the exception of a small portion on the mountain range which forms part of the eastern border, where high or closed forest (mountain forest) occurs and along stream banks (fringing forest), throughout the Colony the woodland is of the tree-veld type with a park-like general appearance. In some parts the tree-veld is comparatively open,

with a few shrubs and abundant grass. In others the trees and associated shrubs are close together and grasses are less conspicuous. Where moisture and soil conditions are especially favourable, the tree-veld approximates to the close-type forest in character. Most of the tree-veld trees are deciduous, though the leafless stage may only last a few days or many months, depending upon the season. An evergreen character is given by irregular flushing into leaf and by the presence of some evergreen trees. In some cases these evergreen trees are the dominant species.

As would be expected, the mountain forest contains trees of large dimensions and tall growth. In the stream-bank forests which fringe many of the streams and rivers intersecting the country tall trees of large girth are met with as well. For the rest of the woodland type, namely, the tree-veld, the trees as a rule have short boles, with large spreading crowns, and, according to locality and soil conditions, vary in height from ten to sixty feet and up to three or more feet in diameter. In specially favourable localities the trees approximate closed forest, and the stems in these cases are longer and the crowns smaller. The smaller dimensions usually occur in areas of shallow soil, dry or very wet situations, or where certain species are on the margins of their natural limits.

The primeval conditions existing before the advent of Europeans have been considerably altered, and man's interference is rapidly bringing about changes. Yet notwithstanding man's interference, it is surprising to note the vigour displayed by many species. Cut-over areas are soon re-stocked by coppice or sucker growth or by seedlings. In certain areas the accidental or wilful burning of the vegetation by hunters to secure early green grass or facilitate the pursuit of game has resulted in the destruction of tree growth over hundreds of square miles. The annual or periodic fires which sweep through the tree-veld of the Colony from end to end, while not doing excessive injury to the virgin woodland, yet cause persistent killing back of young growth. One of the astonishing sights is to note the density of the coppice or root sucker growth which appears after a fire has swept through the tree-veld.

The factors influencing the woodland types and their distribution are temperature, rainfall, elevation, soil conditions, aspect and geographical position.

A. Closed Forest.

(1) *Mountain Forest.*—The mountain forests are confined to the areas of abundant rainfall and high elevation along the eastern mountain range of the Colony. They chiefly occupy the upper and eastern and southern slopes, but occasionally are found on the high ridges, often with a zone of mountain grassland surrounding or above them. These forests are not of great extent. The best example of the type occurs at Mount Selinda, in the Melsetter district. In this forest *Khaya nyasica* reaches large dimensions, up to 200 feet in height, with stems 50 feet in girth.

Associated with *Khaya nyasica* are such species as *Lovoa swynnertonii*, *Trichelia chirindensis*, *Maba mualala*, *Gardenia tigrina*, *Schefflerodendron gazense*, *Pygeum africanum*, *Rauwolfia inebrians*, *Croton sylvaticus*, *Cussonia umbellifera*, *Curtisia faginea*, *Macaranga mellifera*, *Eugenia gerrardi*, *Strychnos mitis*, *Celtis dioica*, *Albizzia chirindensis*, etc. At high elevations *Widdringtonia whytei* and *Podocarpus milanjiana* also occur.

(2) *Fringing Forest.*—In the tree-veld zones belts of evergreen closed forest occur along perennial water courses or old river beds supplied with flood water during the rainy season. To maintain these fringing forests an abundant water supply throughout the year is essential. The species occurring in the stream-bank forests vary with the climatic zones. On the high and middle veld the following are commonly noted:—

Syzygium cordatum, *Eugenia owariensis*, *Eugenia sp.*, *Chrysophyllum argyrophyllum*, *Mimusops kirkii*, *Combretum spp.*, *Rauwolfia inebrians*, *Ilex mitis*, *Myrica æthiopica*, *Trichelia emetica*, *Ekebergia meyeri*, *Pittosporum viridiflorum*, *Diospyros mespiliformis*, *Cettis dioica*, *Acacia campylacantha*. In the Lomagundi district *Khaya nyasica* is met with as a stream-bank tree.

Syzygium cordatum frequently forms small thickets round springs and streams on the main plateau and along escarpments.

Such deciduous tree-veld trees as *Lonchocarpus capassa, Kigelia pinnata, Acacia campylacantha, Pterocarpus sericeus, Acacia spp., Burkea africana, Terminalia sericea, Bauhinia articulata, Strychnos sp.,* and *Diospyros mespiliformis* are often, but not always, found on alluvial soils near river banks or in moist localities such as seepage zones. Where they are in touch with permanent water they are more closely spaced, reach large dimensions and may be deciduous for only a short period. *Phœnix reclinata,* the wild date, is often found on stream-banks, sometimes pure, sometimes in association with fringing forest.

In the low veld the following species may occur in stream-bank forests: *Acacia albida, Acacia camplacantha, Eugenia spp., Diospyros mespiliformis, Trichelia emetica, Khaya nyasica, Kigelia pinnata, Lonchocarpus capassa, Garcinia livingstonei, Cordyla africana, Tamarindus indica* and *Adina galpini.*

The fringing forests usually have an under-storey of small trees and shrubs. Their dense shade limits evaporation, and their roots and stems prevent soil erosion and hold up and break the force of flood water.

Where fringing forests do not occur along the banks of perennial watercourses, species of *Salix* and *Rhus,* associated with the common reed, *Phragmites communis,* are often to be found.

The common or native names of some of the trees mentioned above are as follows:—

Acacia spp.	Various "thorn trees": Muunga, Chinyewe, etc.
Adina galpini	Redwood, Muonya, Mowona.
Albizzia chirindensis	Munjerenje.
Bauhinia articulata	Musegeze, Mutukutu, Habahaba.
Burkea africana	Wild Syringa, Mukarati, um-Nondo.
Chrysophyllum argyrophyllum	Musaza.

Combretum spp.	Mugodo, Mupembere, Inkosikasi.
Croton sylvaticus	Mt. Selinda Linden, Dandashoko, Musugutu.
Curtisea faginea	Assegai wood.
Cussonia umbellifera	Muchaka.
Diospyros mespiliformis	Mashuma, umDhlausa.
Ekebergia meyeri	Mutomo.
Eugenia owariensis	Mukute dombo.
Garcinia livingstonei	Mutunduru.
Gardenia tigrina	Mutambawebungu.
Ilex mitis	Sijarira.
Khaya nyasica	Red Mahogany, Mururu, umBaba.
Kigelia pinnata	Sausage tree, Mubvè, Muveve, Muzangula.
Lonchocarpus capassa	Citamusi, Mupanda.
Lovoa swynnertonii	Brown Mahogany.
Maba mualala	Blackbark, Munyamakungu.
Macaranga mellifera	Musozwe.
Mimusops kirkii	Mutondochura, Muchechete.
Myrica æthiopica	Chinzere.
Podocarpus milanjiana	Ruhombwe.
Pterocarpus sericeus	Mumungu.
Pygeum africanum	Bitter almond tree.
Rauwolfia inebrians	Muhwahwati, Mkadhlwa.
Rhus sp.	Chifuramfu, Fungamfura.
Salix sp.	Willow, Musambangwena.
Schefflerodendron gazense	Mushamba.
Strychnos mitis	Mutambabungu.
Strychnos sp.	Mutamba, Gwati, m'Hlali.
Syzgium cordatum	Water tree, Mukute.
Tamarindus indica	Mseka, Musika.
Terminalia sericea	Yellow-wood, Mangwe, Mususu.
Trichelia chirindensis	Umkuhlu.
Trichelia emetica	Natal Mahogany, Muchichiri, Musikili.
Widdringtonia whytei	Mlanje Cedar, Mpandi.

(To be concluded.)

Tsetse Fly in Southern Rhodesia.

THE SITUATION REVIEWED.

The following reference to the measures taken to combat tsetse fly appears in the report of the Chief Entomologist for the year 1930:—

The tendency of the tsetse fly (*Glossina morsitans*, Westw.) to spread towards its former limits in the Colony has shown no signs of abatement during the year under review. Whilst no areas are known to have been vacated by the pest, except where definite efforts have been made to effect its dislodgment, records of further encroachment have been secured in several localities. This year's record is merely a continuation of the record of preceding years since the great contraction of the fly areas following the year 1896. The unremitting tendency of the fly to spread in all infested districts needs to be borne in mind in connection with the reports on the operations in progress during the year. It is too early to forecast what success is likely to attend the game-reduction measures mentioned in last year's report, which have been inaugurated under the direction of the Native Commissioners over various portions of the fly front. In some localities this measure is admittedly unlikely to achieve the object of checking spread of fly, owing to the nature of the country and paucity of the native population, but in others the prospect is more hopeful. In the one area where this measure has been in operation for a sufficient length of time, namely, the Sipolilo sub-district, useful results appear to have been achieved. Operations were commenced here in 1924, and have been followed by material improvement in the position. With regard to operations proceeding under the direction of the Entomological Branch, a marked effect on the fly population has been produced in the Lomagundi (Umboe) area, and appreciable retrogression of

the limits of the definite fly area is apparent. It is disappointing that some further cases of trypanosomiasis in cattle have occurred on the farms during the year.

In the Gatooma sub-district, whilst all indications are in the direction of improvement rather than the reverse, it is safest not to draw any conclusions at present. It is clear that considerable further progress will need to be made before the farms in this district lie altogether outside the range of wandering flies from the definitely infested area.

It is natural that some impatience should be felt concerning the tardy appearance of fully satisfactory results from these operations, but it is to be realised that control of *Glossina morsitans* constitutes a problem which has not been satisfactorily solved in any part of Africa. I may be permitted to quote the words of Sir Guy Marshall, Director, Imperial Institute of Entomology at the Pan-African Agricultural and Veterinary Conference at Pretoria in 1929, namely:—"There is another point, which, I think, is not altogether realised by many governments, namely, that the eradication of tsetse fly is going to be a very long, slow, and expensive business." This is in reality self-evident from the nature of the problem.

It is regrettable that to date it has not been found possible to make adequate provision for scientific research in reference to the bionomics and ecology of tsetse fly in this Colony. Efforts have been made by the branch in the direction of acquisition of knowledge concerning the life economy of this insect, but field investigations have necessarily been concerned largely with throwing light on the progress of the operations. A properly-staffed and equipped field laboratory for tsetse fly research is undoubtedly highly desirable when the finances of the Colony admit of the necessary provision.

1. Operations, Lomagundi (Umboe).—These operations were commenced in December, 1925, and were extended to a newly fenced zone on the northern side, that is, towards the fly area, in July, 1928. In February, 1930, operations were also extended to the west of the Angwa River, where there were indications of the advancing fly outflanking the fenced zone. The maximum number of native hunters em-

ployed during the year has been forty-two, with two European rangers. The southern fenced area adjacent to the farms was never more than very lightly infested with fly, except close to what is now the middle game fence, but flies could be caught by diligent search in most parts. There were, however, at least two small apparent fly centres south of the fenced zone. The northern zone, on the other hand, was definitely infested with tsetse practically throughout, and in many parts the density was considerable previous to the extension of operations in this region. In the southern area no tsetse flies have been seen throughout the year, except in one locality. An occasional fly was taken in this locality and also south of the southernmost game fence in the same region. Direct and close inspection of the locality failed, however, to reveal any tsetse, and in view of the fact that fly was not found in this locality in previous years, it appears justifiable to deduce that their presence was due to some temporary local factor. In the northern zone the reduction in density of the fly since the commencement of hunting is marked, and may be indicated by the following figures, based on fortnightly collections in certain selected localities:—

Average male density, 1927 (Aug. to Dec.) ...	34.4
Average male density, 1928 (June to Dec.) ...	24.0
(Hunting commenced in July.)	
Average male density, 1929 (July to Dec.) ...	5.8
Average male density, 1930 (July to Dec.) ...	1.5

The figures from 1927 to 1929 refer to exactly the same localities; but the figures for 1930 include other localities, close to the northernmost fence, where the fly was known to be particularly abundant in previous years and still persists in greatly reduced numbers.

Corresponding figures for two localities each four miles beyond the northernmost fence, where the game has not been disturbed, show a much higher density than the fenced zone, both in 1929 and 1930, but there is a considerable apparent reduction in 1930. Whether this, if reliable, is a normal variation, or whether at a distance of four miles the effect of game reduction between the fences is also felt to some extent, is uncertain, but the latter might quite possibly be the explanation. Comparable figures for the two localities north

of the fenced zone give an average male density of 32.4 for 1929 and 16.0 for 1930, but these only cover the period from late September to early November, and the number of collections is insufficient to give a just comparison. The average male density for the whole year 1930 in selected localities four miles north of the fenced zone, including a traverse not utilised in 1929, is 20.7.

Collections off man north of the fenced area in 1930 (game undisturbed) gave a female percentage of 16.8 per cent. (2,316 flies). Similar collections within the northern fenced area (game intensively hunted) during the year gave an average female percentage of 29.6 per cent. (442 flies). *A high female percentage caught off man is judged to indicate hunger conditions.* There is thus a marked difference between the fenced area and the undisturbed zone beyond. The female percentage in the fenced area during 1930 is not as high as might be expected. The average female percentage in this area in 1927, when it was kept practically as a game reserve, was 12.6 per cent. (705 flies). In 1928, the year hunting commenced in this section, it rose to 20.7 per cent. (1,063 flies); in 1929 the average was 40 per cent. (293 flies). The apparent fall in 1930 is presumably due to collections made close to the limiting fence, the localities utilised in previous years being now too unproductive of flies to furnish figures in this connection. With the exception of the small portion between the Tchetchenini Road and the Angwa River, where tsetse is still to be met with in very small numbers not far from the middle fence, fly in the northern zone is now more or less confined to a belt within four or five miles of the northernmost fence. The density even here is comparatively low, but increases as the limiting fence is approached. The fly position in the fenced zone is thus very much improved throughout, and it is disappointing that some of the farmers have had further cases of trypanosomiasis during the year. These cases have been confined to three farms between the Hunyani and Angwa Rivers. The total losses have been small—namely, six head on one farm, four on another, and none at all on the third; but use of the injection issued by the Director of Veterinary Research was apparently responsible for saving the lives of four animals on one farm, nine on another, and five or six

on the third. It is noteworthy that on one of the formerly worst affected farms in this area two spans of oxen have worked for the past two years without a single case of the disease having occurred amongst them. The oxen were regularly injected as a prophylactic measure in 1929, but apparently not in 1930. In addition, a considerable number of European-owned cattle are reported to have ranged freely as far as the southern game fence in this locality without ill-effect.

Trypanosomiasis re-appeared during the year on two farms on the east bank of the Hunyani River, on which no cases had occurred during the previous three years. One farmer lost three head and the other estimates the number of cases at twenty-three. The position is particularly difficult of elucidation, because the second farm is further from the fly area than the first. No fly could be found in the vicinity, and no fresh cases occurred during the latter part of the year. The more distant farm is about fifteen miles in a direct line from the present limits of the definite fly area. It is such sporadic outbreaks, at what would previously have been judged a safe distance from the definite fly area, which are delaying complete success in this particular area.

It is of interest to note that, owing to reports of increase of game in the largely occupied and "open shooting" area south of the fenced zone, native hunters were sent to this area at the request of the local farmers and there destroyed a considerable quantity of game, including such large species as koodoo, sable, etc. This indicates the extent to which European settlement in this Colony may be expected automatically to protect itself against the encroachment of tsetse fly.

2. Lomagundi South-West.—Reconnaissance carried out in 1929 had demonstrated the spread of tsetse northward from the Umfuli River, particularly up the Sisuje River, in the direction of occupied farms in this locality. Early in 1930 steps to prevent the fly from spreading further in this direction were contemplated, and it was hoped to take action in time to prevent cattle on the farms becoming infected. Unfortunately, before action could be taken trypanosomiasis broke out amongst the cattle on two farms,

extending later to a third, and occasioned very considerable losses. A game fence about forty miles long has been erected between the fly and the farms during the year, and operations to drive game back from the farms have been commenced under the direction of a European ranger.

3. Gatooma.—Operations in this area commenced in September, 1927, although the fencing was not completed until April, 1928. The eastern fence was extended further south to the Umsweswe River in March, 1929, and a new flanking fence to protect the northern flank was completed early in the present year (March). These extensions of the fencing were accompanied by corresponding extension of the area hunted. Fifty native hunters under the direction of three European rangers were employed during the year. Increase in the number of hunters, closer European supervision, and extension of the area to be hunted have combined to increase the number of animals destroyed during the year, demonstrating the fact that the fenced area, although from a sportsman's point of view depleted of game, still contains a considerable number of animals, which the natives' knowledge of the forest enables them to secure. There are unmistakable indications of diminution of tsetse in various localities, and fly is now decidedly scarce in a zone several miles wide immediately adjacent to the eastern game fence. Conditions between the fences are, however, not as yet comparable with those in the Lomagundi (Umboe) area.

It is of interest to note that out of 2,146 tsetse flies caught off man *within* the fenced area during the year, the average female percentage was 36 per cent. Out of 1,976 tsetse flies caught off man *west* of the fenced zone, the female percentage was 26 per cent. It should be mentioned that a considerable amount of hunting has occurred in the localities west of the fenced zone where the figures were collected during this year (1930). The collections in the fenced zone included localities immediately adjacent to the western fence, where the female percentage fell as low as 29 to 33 per cent. In localities towards the middle of the fenced area the female percentage rose to from 42 to 51 per cent. The average female percentage in 1927, the year the operations commenced, was 18.4 per cent. (4,203 flies), in

1928 it was 15.4 per cent. (455 flies), and in 1929 it was 23.2 per cent. (815 flies).

Certain farms in this district which sustained losses last year have had few or no cases this year, and no new farms are known to have been involved. Whilst the position cannot be said to have improved appreciably on two outlying farms, the general position has been easier and gives reason for anticipation of further improvement if the operations are continued.

4. Umfuli River.—Owing to cases of bovine trypanosomiasis contracted on farms abutting or near to the Umfuli River above the Magondi Native Reserve, it was decided to attempt to reduce the game in the area adjacent to this reserve. A European was placed in charge of twenty native hunters and proceeded to the area on the 5th November. The number of animals inhabiting this area has been found, however, to be much smaller than anticipated, and the operations will be discontinued. No tsetse flies have been seen in any part of the area.

5. Gwelo North.—The tendency of the fly to outflank the Gatooma fenced area at the southern end—namely, in the region of the Umniati and Ngondoma Rivers—led to a European with fifteen native hunters being despatched to this difficult region on the 14th November. These operations were still in progress at the end of the year.

6. Wankie District.—The attempt to create a line of European settlement along the Gwaai River has been proceeded with under the direction of the Lands Department, aided by a local committee. The number of farms occupied at the end of the year is stated to be fourteen. In order to accelerate the intended effect of the settlement in holding the fly in check, native hunters under the direction of the Native Department have been stationed at intervals along the Gwaai River with the object of reducing the game. Close inspection by a special inspector has revealed the fact that tsetse fly is now established on the western side of the Gwaai River from near the Sikume junction, northwards at least to the Shangani junction, and no doubt beyond. Moreover, the eastern side of the river, along the Victoria Falls road, is infested to a distance of approximately sixteen miles above

the drift at the Dett-Gwaai junction. Definite infestation of the Gwaai River has thus broadened considerably, and the position at present is such as to give cause for disquietude.

7. Control of Traffic from the Fly Areas.—The number of stations for control of traffic from the fly areas amounted to four at the end of the year—namely: (1) Robb's Drift Road, Gatooma, at the eastern game fence; (2) Tchetchenini Road, Lomagundi (Umboe), near the southern game fence; (3) Mcheringe Road, Lomagundi, near the Southern game fence; (4) Miami-Zambesi Road, Urungwe sub-district, Lomagundi district, near the old Native Commissioner's camp, Urungwe.

(1) *Robb's Drift Road, Gatooma.*—The guard was stationed on the road on 30th March. An analysis of the traffic was not kept in full until the beginning of June, but from that date to the end of the year 102 motor vehicles and 184 cyclists were dealt with. The total number of tsetse flies caught on the traffic was 414. It is of interest to note that the percentage of female flies caught on the traffic was actually higher than the percentage normally caught by one person off another in the fenced area. The percentage of females caught in the fenced area during the year gives an average of 36 per cent. Figures collected in reference to traffic at the gate gave a percentage of 62 per cent. females (42 males, 71 females) off motor vehicles and 45 per cent. females (64 males, 53 females) off cyclists. The particular interest lies in the fact that at one time it was not thought that the female flies of this species followed moving objects, or at least human beings, to any great extent.

(2) *Tchetchenini Road, Lomagundi (Umboe).*—Guards were stationed at the gate on 20th February, and from 1st June dealt with 108 motor vehicles and 758 cyclists. Eight tsetse flies only were caught at this gate. It should be mentioned that a very high proportion of the motor traffic originated at a point close to the guard gate near the southern game fence.

(3) *Mcheringe Road.*—Guards were stationed at the gate on 21st February, and from 1st June dealt with 27 motor vehicles and 443 cyclists. Only two tsetse flies were caught at this gate, one in May and one in August, both on vehicles

from beyond the middle fence. Seeing that both the Tchetchenini Road and the Mcheringe Road, especially the former, constitute traffic routes from the undisturbed fly area beyond the fenced zone which both traverse, the number of flies caught at these gates constitutes eloquent testimony to the present tsetse fly position between the fences.

(4) *Miami-Zambesi Road.*—The guards were stationed at the gate near the old Native Commissioner's camp at Urungwe Hill on the 24th November. The amount of traffic has been small, following the advent of rains. Eleven tsetse flies were caught off motor vehicles during December.

(5) *Sinoia-Copper Queen Road.*—In order to test the danger to the occupied farms from tsetse flies which might possibly be carried by traffic along the road leading from the abandoned Copper Queen Mine towards Sinoia, a European was stationed on the boundary of the outermost farm on 23rd July, and remained until the end of the year. He examined all traffic, including motor vehicles, cyclists and pedestrians, travelling towards Sinoia. The traffic which passed out through the gate consisted of 34 motor vehicles, 82 cyclists and 437 pedestrians. The only tsetse fly caught was taken in a hut at the gate after a European cyclist had arrived from the Umfuli River.

8. Reconnaissance and Inspection.—Special reconnaissance to ascertain the present approximate limits of the definite fly area has been carried out by special inspectors in the following areas:—

(1) *Lomagundi South-West.*—This has included all the country between the Tengwe and Umfuli Rivers, the limits of the definitely infested area being traced from the Mchekakasungabeta Hills north of the Umfuli River and east of the Sanyati River as far as the Tengwe River. The infested zone was found to extend only about ten miles from the rivers mentioned, except up the Sisuje River and its vicinity, where a salient occurs. No tsetse flies could be found on the south-east corner of the Magondi Native Reserve.

(2) *Lomagundi West.*—The approximate fly limit west of the Sanyati River has been traced from the Tengwe River northward to the escarpment.

(3) *Umfuli River* (above Magondi Reserve).—A considerable area on both sides of the river has been traversed by myself, and more intensively inspected by a special inspector. No tsetse flies have been seen in this area.

(4) *Gwelo North.*—The tsetse fly position on the Umsweswe and Ngondoma Rivers westward to the Mafungabusi Plateau has been investigated by a special inspector. Fly was found to have spread up the Umniati River above the Umsweswe junction, and between the Umniati and Ngondoma Rivers southward to about the same localities. This constitutes a definite extension of the infested area southward since the last inspection in 1928.

(5) *Wankie District.*—Special reconnaissance was responsible for the information given under section 6.

9. *Technical Investigations.*—These have been confined to the Gatooma fly area during the past year. An entomologist was stationed in this area from the 15th May to the 22nd December, and devoted much of his time to investigation of the breeding places of the fly, and especially to ascertaining the amount of breeding proceeding in the game-depleted area between the fences. The investigation revealed a marked change in breeding-sites according to the season of the year and the condition of the forest in respect to foliage. No breeding was demonstrated in the eastern half of the fenced area, and on the other hand breeding increased towards the western fence. The number of living puparia collected corresponded roughly with the density of adult flies. Observations were also made concerning natural enemies of the tsetse, including parasites and percentage of parasitisation. The percentage of parasitisation was comparatively low, but the major parasites of *Glossina*—i.e., *Mutillids* and *Bombyliids*—were represented. Notes were kept on the percentage emergence of tsetse flies from the puparia throughout the period covered. In the course of a short visit in February an entomologist demonstrated the fact that breeding was continuing during the height of the wet season, thus corroborating observations made on the Umniati River during the same month in 1923.

10. Experiments with Tsetse Fly Traps.—Reports of large capture of tsetse fly by means of a trap in Zululand

and absence of any information concerning the nature of the trap led to preliminary experiments being conducted in June and July in reference to the attraction of tsetse flies into shaded enclosures. These revealed the fact that the flies were attracted even into such small enclosures as petrol boxes lying on their sides on the ground. An experimental trap was then constructed on the principle of primary attraction of the fly into shade and thence towards light, and was first exposed in the fly area on the 8th August. A large number of tsetse flies were caught in this trap, which was not, however, fully satisfactory, and further modified models were accordingly constructed and tested. In the meantime, particulars of the Zululand trap were obtained, and a model of this pattern was also constructed and tested, after the writer had witnessed the demonstration in Zululand on 11th and 12th November. All the traps, including the Zululand model, have caught tsetse flies (*Glossina morsitans*), but considerable further experimentation is necessary before any statement can be made concerning the prospect of any of these, or further modifications on the same principle, proving of practical value in reference to the control of *Glossina morsitans*.

Seeds for Sale, Gwebi Farm.

S.E.S. Hull-less oats	40/- per 150 lbs.
Large black sunflower seed	14/- per 100 lbs.
Linseed	60/- per 200 lbs.

Linseed in quantities less than 100 lbs in weight, 4½d. per lb.

Sweet potato tubers (Calabash variety)	6/- per bag of 150 lbs.
Napier grass roots	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

Salisbury Agricultural Experiment Station.

ANNUAL REPORT, 1929-30.

(Continued.)

By H. C. ARNOLD, Manager.

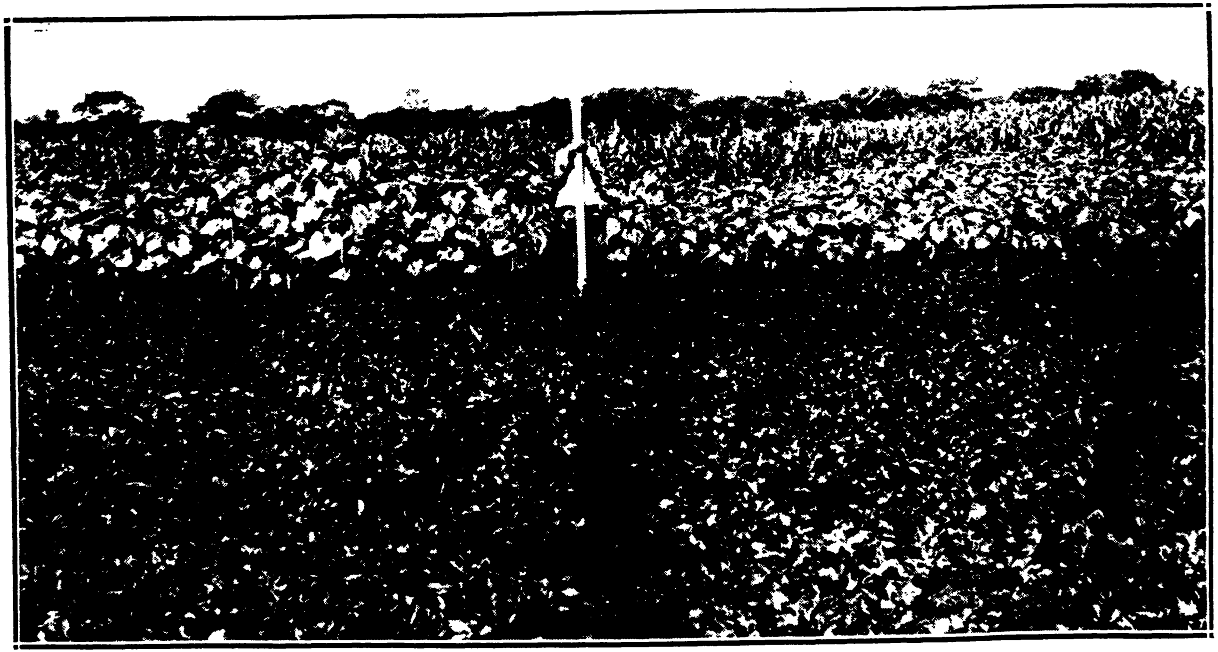
(Published with the approval of the Chief, Division of Plant Industry.)

LIMING TRIALS.

First Series.—These trials were commenced five years ago, in 1925-26, when duplicate strips of land were dressed with half-ton and one ton of lime per acre respectively. Two control strips which received no lime were included. These strips have been crossplanted each year with maize, cotton, ground nuts, sunflowers and haricot beans. During the first three years the various crops were planted on the same plots each year, but since that time they have been rotated in the order given.

The whole area was dressed with eight tons of farm manure per acre in 1927, and with 250 lbs. per acre of bone and superphosphate in 1928.

Lime being a slow-acting agent it may be assumed that it had little effect during the first year following its application and that the yields during that season, namely, 1925-26, reflect the degree of fertility of the land at the commencement of the experiment. Therefore from the differences between the total yields for the past four years and those for 1925-26 the effect of the lime treatment may be



LIMING TRIALS, AGRICULTURAL EXPERIMENT STATION, SALISBURY.

The land to the left of the picture has been dressed at the rate of three tons of lime per acre; that on the right has not been treated. The crops are ground nuts, sunflower and maize (in the background).

judged. The returns tabulated below indicate a steady increase of yield of maize from the limed plots since the second season.

Yields of Maize in Bags per Acre.

Treatment	1925-26	1926-27	1927-28	1928-29	1929-30	Totals 4 years, 1926-30	Differences.	
							Four-year totals and season 1925-26	Increase due to treatment.
One ton of lime per acre ...	21.3	18.00	16.65	12.45	12.32	59.42	38.12	9.95
Half ton of lime per acre ...	24.7	19.95	18.00	15.40	13.34	66.69	41.99	13.82
No lime ...	20.6	13.20	12.60	11.29	11.68	48.77	28.17	...

The returns for season 1925-26 indicate that the land which received the half-ton dressing was naturally more fertile than the other plots, and it is probable for this reason that higher yields have been obtained from those plots each season, which makes it necessary to regard with reserve the indicated increase of 13.82 bags per acre. It is thought that the plots which received the one-ton dressing present more reliable evidence of the effect of the lime, and they indicate an increased yield of approximately ten bags of maize per acre, over a period of five years as a result of the treatment.

Owing to the lack of uniformity in the inherent fertility of these plots it was deemed advisable during the second season to divide them, and after ascertaining the crop-producing power of each of the halves, to make further applications of lime before continuing the trials the following season. Hence on one half of each of the plots which had previously been treated at the rate of one ton of lime per acre a further similar dressing was given; on one half of each of the original half-ton plots an additional half-ton was applied, and on one half of each of the plots which had not previously been limed, a dressing of three tons per acre was applied.

In this series, therefore, we now have duplicate plots which have received lime at the following rates in tons per acre: 0; ½; ½ plus ½; 1; 1 plus 1; 3. In the tabulation below are shown the average yields of duplicate plots for the season before the second applications were made, as well as those for the subsequent seasons. The columns are arranged in the same order as the plots occur in the field.

Yields of Maize in Bags per Acre.

Treatment, August, 1925	One ton of lime		Half ton of lime		No lime	
Yields 1926-27 ...	17.10	17.40	19.95	18.75	13.20	13.05
Second treatment, August, 1927, on one half of each of the original plots		One ton lime		Half ton lime		Three tons lime
Yields 1927-28 ...	16.65	17.40	18.00	17.25	12.60	17.55
,, 1928-29 ...	12.45	12.56	15.37	14.92	11.29	14.47
,, 1929-30 ...	12.32	13.78	13.33	12.96	11.68	14.51
Totals, 3 seasons ...	41.42	44.74	46.70	45.13	35.57	46.53
Difference — due to second treatment ...	3.32		- 1.57		10.96	
Average annual difference	1.10		- .52		3.66	

Examination of the yields during the season 1926-27 shown in the central pair of columns shows that the land to which the second application of a half-ton of lime was made, was less fertile than that on the plots which received no additional lime, the difference in yield being 1.20 bags per acre. The application of half a ton of lime appears to have increased the yield of the treated plots so that after the dressing was applied the three-year average was only half a bag less than that of the treated plots, which indicates that this small dressing of lime increased the yield of those plots by approximately .68 bags per acre per annum. From the returns shown in the left-hand pair of columns it is seen that although the yields of the two halves of the plot which received the one-ton dressing in 1925 were about equal in season 1926-27, those on the half which received an additional ton of lime were increased by one bag per acre per annum. There is also a very striking difference in favour of liming where

the heavy dressing of three tons was applied to land which had not previously been treated.

Second Series of Lime Trials.—Owing to the slow action of lime, its beneficial effect may be expected to continue over a period of years; this being so, in experimental work designed to investigate its effect on the soil, care needs to be taken to prevent the intermixing of the soil of treated and untreated plots during the cultural operations necessary in the growing of several successive crops. It was thought that the plan of the first series did not fulfil these conditions very satisfactorily, so it was decided to extend these trials by commencing a new series on another area, and to adopt a plan which would prevent the transference of soil from the limed to the unlimed plots as far as is practicable.

In 1928, two strips of land which were carrying maize were each divided lengthwise, and each of the four strips thus obtained were divided crosswise into six sub-plots, and the yield of each of the twenty-four sub-plots was recorded. Later, the two central strips of sub-plots were dressed with agricultural lime at the rate of one ton per acre, and the two adjoining strips were left untreated. The land was then ploughed in the usual way. In this experiment, therefore, each of the sub-plots which has received lime has a neighbouring sub-plot which has not been treated, and each pair of sub-plots has received exactly the same treatment in all other respects over a period of several years.

The table below shows the four groups of sub-plots and the yield of each during the season 1927-28 (before the trials began) and in the next column are shown the combined yields for the two seasons 1928-30 (following the application of lime to two groups). The whole area received farm manure in 1926-27 at the rate of 6 tons per acre.

Yields of Maize in Bags per Acre.

	Plots fertilised for tobacco 1926-27				Maize in 1926-27 (no artificial fertiliser)			
	1927-28 Before trials began	1928-30 No lime	1927-28 Before trials began	1928-30 One ton lime per acre	1927-28 Before trials began	1928-30 One ton lime per acre	1927-28 Before trials began	1928-30 No lime
	18.48	27.12	17.64	28.92	15.24	26.07	16.68	24.18
	20.52	22.11	19.20	23.19	13.32	20.43	12.48	15.84
	20.64	30.06	19.68	33.60	14.28	27.12	14.16	20.64
	19.56	26.28	18.24	30.78	15.36	25.14	16.08	19.80
	20.16	18.00	18.84	23.94	13.32	27.36	14.04	26.22
	18.24	21.66	19.32	31.26	16.44	27.30	18.00	23.52
TOTALS ...	117.60	145.23	112.92	171.69	87.96	153.42	91.44	130.20
Averages ...	19.60	24.20	18.82	28.61	14.66	25.57	15.24	21.70
Difference between average yeld 1927-28 and 1928-30	+4.60		+9.79		+10.91		+6.46	

By comparing the yields quoted in the left of each pair of columns the degree of fertility of the various sub-plots before this experiment began can be gauged. They indicate that the average fertility of the sub-plots which were subsequently limed, was at that time slightly lower than those which received no treatment. Since the application of lime, however, the sub-plots which received the dressing have in every case given heavier yields than their counterparts which were not treated. These results indicate an average increased yield of 4.82 bags per acre during the two-year period 1928-30 as a result of applying one ton of lime per acre.

In the third series of trials, on a block of sixteen plots arranged after the manner of squares on a chess-board, alternate plots were dressed with lime, four receiving half a

ton, and another four one ton of lime per acre. In the season 1928-9 maize was grown, and during the season under review leguminous crops for hay were sown on this area. The tabulation below shows the average yields of the plots under different treatments, before and after the application of lime in August, 1928.

Yield of Maize in Bags and Hay in Tons per Acre.

Maize, 1927-28 (before liming)	Treatment, August, 1928	Maize, 1928-29, average of all plots	Legume hay, 1929-30
8.48	1 ton lime (4 plots)	8.37	3.01
8.56	½ ton lime (4 plots)	7.70	2.54
8.27	No lime (8 plots)	6.77	2.49

In these trials the hay crops reaped from the plots which were not dressed with lime, was about equal to that of the land which received the half-ton dressing, but the heavier dressing of lime resulted in improved growth and an increased yield of half a ton of hay per acre.

All three series of experiments recorded above point to the fact that applications of lime to soils of the type met with on this station are of material benefit in increasing crop production, but it remains a moot point as to whether a similar expenditure on artificial fertilisers or fertilisers combined with green manuring might not afford an even more favourable financial return. Enquiry into this aspect of the case is in progress.

(To be continued.)

The International Exhibition, Elizabethville, 1931.

In accordance with the preliminary announcement, this Exhibition was duly opened by the Governor of the Katanga, Colonel Heenen, on the 15th May. Southern Rhodesia, Northern Rhodesia and the Rhodesia Railways combined to rent a pavilion and stage a joint exhibit, the building being known as the Rhodesian Pavilion.

The arrangements for exhibits from Northern Rhodesia were in the hands of the small committee at Livingstone; those from Southern Rhodesia were arranged for by the Chief, Division of Plant Industry; and those from the Railways by Mr. R. L. Drage, Assistant General Manager.

Mr. R. Palmer, Senior Grain Inspector, Southern Rhodesia, was deputed to proceed to the Katanga early in May to undertake all preliminary arrangements in regard to the erection and fittings of the pavilion and to remain there until the close of the Exhibition on the 7th June. Mr. H. G. Mundy, Chief, Division of Plant Industry, proceeded to Elizabethville on the 8th May to supervise the staging of the exhibits and in the capacity of Chief Exhibition Representative of the three parties concerned.

The pavilion measured approximately 50 by 25 feet, and was provided with staging along all four walls, together with an attractive central stand for railway publicity matter. Mr. R. Falk of the Railways was in attendance for nine days in charge of the latter section.

The exhibits from Southern Rhodesia comprised the following:—

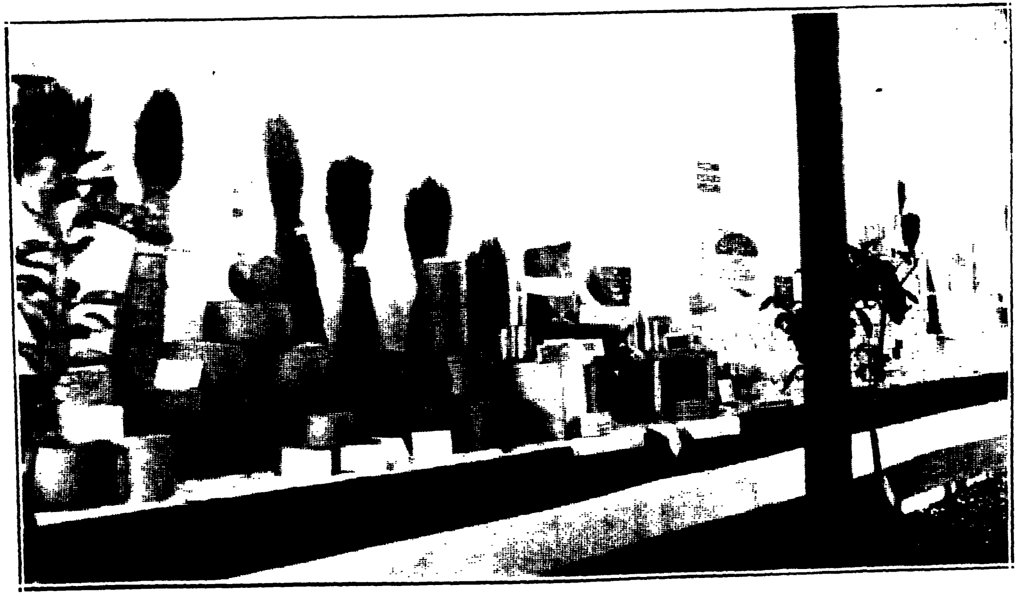
1. The Wankie Colliery Co.: Coals of different grades, coke, bricks, fire bricks, etc.
2. The British South Africa Co.'s Estates: Citrus trees and citrus fruits in boxes for export, also photographs.
3. Captain J. M. Moubray, Shamva: Ditto and native twist tobacco.

4. F. Issels & Sons, Bulawayo: Iron foundry products and photographs.
5. The Rhodesia Export & Cold Storage Co., Bulawayo: Hams, bacon, butter, lard, sausages, etc.
6. The Rhodesia Milling & Manufacturing Co., Bulawayo: Gloria flour, Reliance, Rainbow and blue mottled soap, etc.
7. Messrs. Wightman & Co., Bulawayo: Assorted appliances and foods for the poultry farmer.
8. J. Haskins & Sons, Warmley Cheese Factory, Francistown: A large exhibit of cheeses.
9. The Department of Agriculture, Salisbury: Grains and seeds of Southern Rhodesia, native grasses and wheat and oats in sheaves.
10. The Farmers' Co-op. Society, Ltd., Salisbury: Grains, seeds and potatoes, washing soda, soft soap, lard, ground nut cake and meal, etc.
11. The South African Explosives & Industries, Ltd., Salisbury: All types and combinations of artificial fertilisers in common use in Rhodesia.
12. The Central Cotton Ginnery, Salisbury: Ground nut and cotton cake and meal, cotton linters and hulls, and cotton and ground nut oils.
13. The United Tobacco Co.'s Factory, Salisbury: A complete range of all pipe tobacco and cigarettes manufactured in their Salisbury factory of 100 per cent. Rhodesian leaf. Samples of same for free distribution.
14. S. Koefman, Salisbury: Assorted tobaccos and snuff as prepared for the native trade.
15. Newmarch & Maclean, Salisbury: Posters, photographs and seed and table potatoes.
16. The Government Geological Department, Salisbury: Framed geological maps of Southern Rhodesia.
17. The Gourock Ropeworks, Salisbury: Tent, tent fittings, water sacks and various types of canvas, etc.
18. The Rhodesia Railways: Publicity matter, including a most attractive pictorial map of Southern and Northern Rhodesia, publicity posters and brochures, and admirable panoramic and other photographs of the Victoria Falls and other features of interest to the tourist in Southern Rhodesia.

As large an attendance of visitors from overseas as was expected did not materialise, but the Exhibition was well attended by the inhabitants of the Belgian Congo and Northern Rhodesia, together with a fair sprinkling from Southern Rhodesia, the Union of South Africa and elsewhere.

The general effect within the Rhodesian Pavilion was extremely pleasing, and the opinion was freely expressed that it formed one of the most attractive and interesting in the whole Exhibition, primarily on account of the wide variety and excellent quality of the exhibits which it housed. A number of enquiries were received regarding the possibilities of obtaining agencies to represent Rhodesian exporters, and enquirers were placed in direct touch with the producers concerned. The Chief, Division of Plant Industry, is of opinion that given suitable representatives in the Katanga a considerably increased trade—particularly in articles for human consumption—could be developed.

An attitude of the greatest helpfulness and cordiality towards Southern Rhodesia and her representatives was displayed by all the officials of the Katanga from the Governor downwards, and by the inhabitants of Elizabethville; and the participation in the Exhibition of the two Rhodesias and the Rhodesia Railways was, it is believed, regarded as a gesture of friendliness which should do much to foster trade relationships in the future.



Some of the Southern Rhodesian exhibits within the Rhodesia pavilion at the International Exhibition, Elizabethville.

Maize Harvesting and Export.

By the Division of Plant Industry.

A short article prepared by this Division on the above subject was published in *The Rhodesia Herald* on the 5th June, the reports received from various farmers on their harvesting methods not having been summarised in time for inclusion in the June issue of the *Rhodesia Agricultural Journal.* The following is a summary of the article referred to:—

Stooking.—In the early part of the season, and where white ants are not prevalent, the cut stalks should be allowed to remain spread on the ground for a day or two so that all leaves may dry thoroughly before collection and erection into stooks. The diameter of stooks should not exceed eight feet at the base, and the stooks should be built in such a way as to allow as large an air space as possible in their centres. If preferred, the stooks may be made in a continuous or nearly continuous line across the whole length of the field, but in this case again special care should be taken to maintain as large a central air space as possible.

Reaping from Stooks.—When reaping from stooks generous beds of stover should be prepared, and after removing part of the outer envelope from the cobs the latter should be spread evenly over these stover heaps to a depth of not more than six inches. Having remained thus exposed to the sun and wind for a period of at least three weeks, it is usually found that the cobs have dried out sufficiently to be carted with safety to the dump. But if the grower is at all doubtful as to the dryness of the grain, he should not commence carting for a further week or ten days.

Reaping the Standing Crop.—Reaping from the standing main crop should not be commenced before mid-June at the earliest. Even so, a considerable part of the husk should be removed from the cobs, and the latter should be

spread out fairly thinly on stover or on the ground for as long a period as possible before collecting. On lands where white ants are prevalent the ears should be laid on beds of stover in the same way as when reaping from stooks.

Making the Dump.—Care should always be taken to place enough dunnage at the bottom of the dump to ensure that no trouble will be experienced from moisture rising from the ground, or from the ravages of white ants.

Small dumps no higher than six feet are strongly recommended. Each time fresh supplies are ridden to the dump the cobs should be spread evenly over the surface of the stack, and should not be thrown out in a heap in one spot, as is so frequently the practice. If, as is often the case, more dumps than one are available, then, if possible, one day's riding should be placed on one dump and the following day the other dump should be used, thus allowing each layer of cobs the fullest opportunity of drying out before another is placed above it.

A point of great importance is that while dews are prevalent it is not advisable to ride on fresh cobs until the sun has thoroughly dried out the entire surface of the dump.

Stacking Maize after Shelling.—Maize after shelling should not be block stacked on the farm, but "pigeon-hole" stacking as described on page 477 of the May issue of this Journal should be adopted. If, however, the grower is at all uncertain of the moisture content of his maize, all bags should be left standing upright with the mouths unsewn for several days before stacking in the "pigeon-hole" manner, and a carefully drawn composite sample of the grain should be forwarded to the Department of Agriculture for moisture test.

Taking Samples for Moisture Test.—To obtain the necessary samples, small quantities of maize should be drawn from the centres of about twenty bags, the grain in which was shelled from ears from the centre of the dump. These small quantities are thoroughly mixed together and a sample about 2 lbs. in weight is then drawn. This sample should be immediately enclosed in an air-tight tin (such as a golden syrup tin) and despatched without delay to the Department of Agriculture, care being taken that the tin is not exposed to the sun while awaiting despatch.

Mycological Notes.

DIPLODIA—AN OPPONENT OF MAIZE GROWING.

By J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.,
Government Plant Pathologist.

During this unfortunate period, when general economic depression has given such a severe setback to the maize industry, a certain section of our community is seriously doubting the advisability of growing maize, whilst certain individuals are definitely opposed to the production of the crop. It does not, however, appear to be fully realised amongst our farmers that there has always been another set of individuals who work in the dark, whose activities are always cloaked in the greatest secrecy, and whose avowed object is to hamper the growth of the maize industry and extract an exorbitant tithe from the struggling grower. This secret society has been "shown up" on several occasions in this Journal; but despite the efforts of a few enthusiasts, the remorseless racketeering is still allowed to proceed, almost unchecked, at the cost of many thousands of pounds sterling to the primary producer. In fact, the monopoly possessed by Diplodia is even supported by the growers, for whenever a high-jacker appears in the guise of witch weed, army worm, or the like, every effort is immediately concentrated upon his extermination, but Diplodia is allowed free run of the crop. Why? Oh, why is the invisible foe allowed to pass unheeded when the whole Colony is immediately up in arms upon the first appearance of his visible brothers? Are we in Rhodesia so endowed with mediaeval mentality that we must needs adopt such fatalistic attitude towards perils unseen as to bring about our own confusion? Some say, "We have tried your remedies" (for one or two seasons), "but we can see no improvement in our fields."

Again the need for a visible sign. "Who," it may be asked, "is expected to see an improvement in the fields? Who is considered a sufficiently competent judge to discern by an inspection of the fields an average difference of four or five bags per acre over a number of years?" Outward and visible signs are forever misleading, especially in relation to crop improvement. It is in the farm books that differences should be apparent; but whoever seeks the truth in farm books?

Carefully planned and controlled trials in germinators, pots and field have proved that treatment with a suitable dust considerably improves the yield of maize from commercial seed, whilst detailed investigation has revealed the life histories of the fungi causing disease and their vulnerable points. Why, therefore, should so little faith be put in remedies devised from the common-sense application of known scientific facts?

The life history of Diplodia(1) and the effect of seed treatment(2) have been fully described in previous issues of this Journal, and demonstrated at the Salisbury Agricultural Show. The measures advocated for control of the diseases may be summarised as follows:—

1. Select only cobs which are free from any signs of mouldiness and which are well covered by the husks.

2. Treat seed with a suitable fungicidal dust before planting in order to ensure a good stand.

3. Destroy as much as possible of the trash which remains after cattle have been fed, preferably by burning or rotting down for at least a year. This is the only way to prevent the distribution of the fungus "seeds," called spores, which alone are responsible for the mouldy cobs which are reaped each year.

Seed treatment does not protect the cob, but it does protect the seedling.

REFERENCES.

(1) HOPKINS, J. C. F. "What is Diplodia in Maize?" *Bull. 742, Dept. of Agriculture,* S. Rhodesia. 1929.

(2) HOPKINS, J. C. F. "Mycological Notes." *Bull. 747, Dept. of Agriculture,* S. Rhodesia. 1929.

Maize Control Act, 1931.

Maize growers, millers, dealers and other persons interested in the maize industry should note that the "Maize Control Act, 1931," which was published in the *Gazette* of the 5th June, 1931, provides that all maize and maize meal held by any producer as on the first day of June, other than maize and maize meal required by the producer for consumption in terms of the Act, and all maize or maize meal held by trader-producers or dealers on the first day of June in excess of 15,000 bags and maize or maize meal required for the completion of lawful contracts duly entered into on or before 3rd April, 1931, and duly registered, must be vested in and become the property of the Maize Control Board.

The following Government Notices have been published:

No. 356 of 5th June, containing regulations establishing the Board in terms of section 4 of the Act.

No. 387 of 12th June, containing regulations concerning returns by producers, dealers and trader-producers, and inspection fees levied on maize and maize meal imported from Portuguese East Africa.

No. 403 of 9th June, containing regulations concerning the classification, etc., of maize to be delivered to the Maize Control Board.

All growers, dealers and trader-producers are required to submit returns to the Board indicating the quantities of maize or maize meal in their possession on the 1st June.

Growers who are members of a co-operative association and are under an obligation to deliver their maize to the association should send their returns to their association and not to the Board direct.

Producers should note that the first returns sought relate only to maize actually reaped for consumption or delivery, and further returns must be submitted at intervals as crops are realised.

All maize growers, trader-producers—that is, persons acquiring by purchase, barter or other means, maize grown by or on behalf of natives for the purpose of re-sale—and dealers—that is to say, persons who acquire by purchase, barter or other means, maize in an unground state for the purpose of manufacture or sale, or who import maize or maize meal for the purpose of re-sale—must register either as growers, trader-producers or dealers, giving their full name and address.

Such applications for registration must be sent to the Acting Chairman of the Board, c/o Department of Agriculture, Salisbury.

Growers who desire also to be registered as trader-producers should notify the Board as aforesaid.

Any maize grown in the following areas is exempt from the provisions of the Act: The native districts of Inyanga, Umtali and Melsetter; that portion of the Sebungwe native district lying to the west of a line running north and south passing through the Native Commissioner's station at Gokwe; the native districts of Wankie, Nyamandhlovu, Bulawayo, Bubi, Insiza, Umzingwane, Matobo, Bulalima-Mangwe, Gwanda and Chibi.

It should be noted that any maize *bona fide* intended for seed shall not vest in the Board and may be sold by the producer thereof at a price not less than 5s. per bag in excess of the current price of maize fixed by the Board from time to time.

The opening prices of standard maize have been fixed at the following rates:—Salisbury, 10s.; Gwelo, 10s.; Bulawayo, 10s. 6d.; Fort Victoria, 11s.

Clause 10 of the Act provides that the Board shall grant to all producers, trader-producers and dealers participation certificates in respect of all maize or maize meal delivered to the Board. These certificates may be ceded and the cession registered in the books of the Board.

Inter alia the Board has power to enter into contracts for carrying out any work in connection with the handling, milling, treating, storage, grading, sale or export of maize and maize meal.

Also to make interim distribution to producers, trader-producers and dealers of the proceeds of any sale of maize

or maize meal after deducting therefrom the amount of any advances or disbursements.

Also to decline to accept any maize or maize meal deemed to be unsuitable.

The following have been appointed members of the Control Board as from 5th June, 1931:—Official member, E. R. Jacklin; Salisbury Chamber of Commerce representative, H. Garmany; Bulawayo Chamber of Commerce representative, Captain F. E. Harris; consumers' representative, R. W. Arthur; Maize Growers' Association representative, G. G. Sanderson; Farmers' Co-op., Ltd., representatives, R. Newett and H. V. Wheeler; Fort Victoria Farmers' Co-op. Society representative, W. B. Richards; Midlands Farmers' Co-operative, Ltd., representative, J. W. Watkinson; Matabeleland Farmers' Co-operative, Ltd., representative, K. M. Goodenough.

DATES OF AGRICULTURAL SHOWS.

Umtali Agricultural Society, Umtali, 24th and 25th July.

Bindura Agricultural Society, Bindura, 25th July.

Rusape Agricultural Society, Rusape, 7th August.

Rhodesia Agricultural Society, Salisbury, 26th and 27th August.

Bulawayo Agricultural Society, Bulawayo, 2nd and 3rd September.

The Rhodesia Railways have agreed to grant the same concession on the road motor service as that allowed when show exhibits are sent by rail, *i.e.*, full rates will be charged on the forward journey, and, if unsold, the exhibits will be returned to the senders free of charge, provided the necessary certificate is obtained from the secretary of the show.

Owing to the outbreak of foot and mouth disease, the Executive of the Midlands Agricultural Society has decided to postpone the Gwelo Show, advertised to be held on the 12th June, to a date to be notified later.

Agricultural Research in Southern Rhodesia.

The following extracts from the report of the Chief Agriculturist and Chief of the Division of Plant Industry for the year 1930 *indicate the nature of the work in progress at the various Government experiment stations:—*

Agricultural Experiment Station, Salisbury.—A report dealing with the principal results at this station is published annually in the *Rhodesia Agricultural Journal.* Selections of Sunn hemp made with the object of obtaining strains which will produce seed more freely gave encouraging results. Experiments with raw rock phosphate and (19 per cent.) superphosphate have supported those of previous years by indicating that weight for weight the rock phosphate is as effective as the superphosphate, though somewhat slower in action. Fertilisers applied to the ground nut crop on moderately heavy red land seem singularly ineffective. Small increases from phosphatic fertilisers have been recorded, but the value of the increase is usually less than the cost of the fertiliser. Various methods of applying fertiliser to the maize crop have been the subject of investigations during the past two seasons and promise to yield results of economic importance.

Mr. Arnold, manager of the station, has recently given considerable attention to selective breeding with oats, with the result that improved strains which are reliable when grown as summer crops are now available. One of these produces hull-less grain of high feeding value which it is believed will prove especially valuable to poultry keepers and dairy farmers. Work on similar lines has produced superior strains of white-seeded and black-seeded sunflowers, and seed of these also is available in small quantities for distribution to farmers.

The area under pasture grasses has been extended with a view to investigating the stock-carrying ability of some of

the more promising species. Legumes suitable for depasturing, and in particular clovers, are receiving increased attention.

The systems of crop rotation under investigation continue to provide much useful information, and afford striking evidence of the value of systematic cropping, coupled with the judicious use of artificial fertilisers.

Sand Veld Research Farm, Marandellas.—After careful examination of a large number of sand veld farms, it was finally decided that all the conditions required were best met by a certain section of Lendy Estate at Marandellas. Three thousand two hundred and twenty acres of this land were purchased, and actual development operations were commenced in February. The farm has been divided into four sections, namely (1) the Tobacco Research Station, (2) the Sand Veld Experiment Station (dealing with all crops other than tobacco), (3) the Pasture Research Station (under direction of the Chief Chemist) and (4) the Commercially Farmed Section.

Five hundred thousand bricks were made, and delivered by contract to the various building sites to relieve the pressure of ox labour for more direct farming activities.

The grazing on the farm is not of the best, being largely confined to wet vlei land which after early December provides only sour and unpalatable feed. But this natural pasturage can greatly be improved by close paddocking, by rotational grazing and mowing, by suitable fertiliser treatment and by the introduction of clovers. It is felt that the development and management of the vlei pastures on this farm will offer an interesting and fruitful line of enquiry.

The Experimental Section, which at present is 100 acres in extent, has been developed very rapidly in the limited time available, and this season there will be 50 acres under experimental plots. It is intended that this should become the principal sand veld experiment station of the Colony.

Tobacco Experiment Station.—Owing to a reduction in the Vote, fewer apprentices than usual could be enrolled at this station. Useful work has, however, continued to be performed both in the direction of agricultural education and in that of crop experiments.

Reference was made in my last report to an outbreak of eelworm, or nematode, in the tobacco fields. It is of interest to record that by thorough desiccation of the soil during the winter months by means of several ploughings and ridgings, the pest was largely controlled, and good tobacco was subsequently grown on the affected land.

The general crop work was again expanded by additional acreages brought in for summer experiments, and further vlei land brought under the plough for winter crops. The total area under cultivation was 135 acres.

Tobacco.—Three hundred and fifty-eight experimental plots were under tobacco, the principal work comprising "topping" and priming trials carried on in co-operation with the Chief Tobacco Adviser, "white mould" experiments under the direction of the Plant Pathologist, and nematode investigations under the supervision of the Chief Entomologist, together with variety trials and rotation and fertiliser experiments. Field trials were also carried out with the J. I. Case mechanical tobacco transplanter. Excellent yields from tobacco following green manure crops were obtained, an average of over 1,000 lbs. of leaf being reaped per acre. Some 10,000 lbs. of graded leaf was marketed, of which 9,039 lbs. was purchased by the Imperial Tobacco Company at prices ranging from 4½d. to 1s. 6d. per lb.; revenue from this source amounted to £360 3s. 9d. A further 7,000 lbs. of tobacco from the previous year's crop (1928-29) was graded, baled and despatched to the Tobacco Pool for disposal.

Apprentices.—An average of fourteen apprentices has been maintained, and appreciation of the value of the instruction afforded is widely expressed by parents and guardians. In most cases, too, good reports are received from subsequent employers of apprentices after they leave the station.

In August a fourth group of apprentices completed their two years' course of training, making a total of 31 young Rhodesians who have taken their certificates since the inception of the scheme. All apprentices who left the station this year on completion of the course took up positions on farms.

The system of plot work continues to provide an excellent medium for training, and it is apparent that many

apprentices who are unable readily to absorb theoretical instruction can yet learn and retain their knowledge by doing all the practical work on their respective plots with their own hands.

Bulawayo and Gwelo Demonstration Stations.—These two stations continue to supply useful information to the officers of the Division, and through them to the farmers of the districts in which the stations are situated. Farmers in the vicinity of Gwelo have shown considerable interest in the work carried on at that centre, but the same cannot be said of Matabeleland farmers in respect to the Bulawayo Station, and in view of the experimental work which will be conducted as a part of the operations of the Matopo School of Agriculture, there would seem no reason why the Bulawayo Station should not be closed down at the end of this season and the money thus saved be put to more advantageous use.

Enkeldoorn Demonstration Station.—This station is worked co-operatively by the Department in conjunction with Mr. P. O. Brocklehurst, of Belvoir Spinney, on whose estate it is situated. It has now completed two seasons, and during November was planted for the third year. The best maize yield recorded in 1929-30 was 10.5 bags an acre, and the lowest yield was 6.75 bags an acre. All other crops gave equally good returns, and the year's work may be regarded as highly successful.

The winter cereal experiments on this farm have been discontinued and transferred to the farm Uitkijk, owned by Mr. C. W. Lamprecht, where the soil—veld land—is more typical of the average winter cereal lands of the Charter district. Four acres are under experimental treatment on this farm. The green manure crops in preparation for wheat to be seeded next April were sown in October.

Remarkable Results follow Stock-Feeding Experiments.

MINERALS INCREASE GROWTH, MILK AND FLEECE YIELDS.

A TRIUMPH OF EMPIRE TEAM WORK.

(*From a Special Correspondent.*)

Remarkable increases in the yield of milk and wool, and in the growth rate of lambs, obtained both by feeding small amounts of minerals to stock and by using mineral fertilisers, are recorded in a report just published by the Economic Advisory Council on "The Mineral Content of Natural Pastures."

The results of these experiments, which were carried out during the last two years in Kenya, apply equally to wide areas of natural pastures in South Africa, Australia, New Zealand, Rhodesia and other parts of the Empire.

Minerals, it is now known, are found in pastures as well as in mines. Scientists have shown that a deficiency of minerals in the herbage causes serious disease and lowers vitality in stock. These experiments prove that the addition of minerals will increase the yield and improve the health of animals grazing on pastures where the deficiency is not so marked as to cause disease.

Power of Common Salt.—An Empire-wide scheme for tackling the mineral deficiencies problems was launched in 1926, centred at the Rowett Research Institute in Aberdeen, and the Empire Marketing Board met the costs by grants totalling £25,000. In 1928 the Kenya Government handed over their experimental stock farm at Naivasha for the investigation described in the report. It was carried out co-operatively by Rowett Institute scientists working in

Kenya and by Kenya agricultural and veterinary officers. Valuable work within the scope of the scheme has been done in Australia, New Zealand and Rhodesia. The pioneer research which made possible this Empire-wide investigation was largely carried out at Onderstepoort in South Africa. The whole enquiry is, therefore, a remarkable example of Empire team work.

The Kenya tests show that common salt alone, used as a fertiliser, increased the yield of the most deficient pastures by 25 per cent. Nitrogen and phosphates actually raised the yield of herbage by 400 per cent. Grazing animals showed a definite preference for the fertilised plots.

"Eat More Minerals."—Direct feeding of minerals to the animals had equally remarkable results. A mineral supplement increased the milk yield of dairy cows by 30 per cent., speeded up the rate of growth of lambs by 10 per cent. and added 10 per cent. on to the fleece weight of sheep.

Four centres in Kenya—Naivasha, Molo, Nakuru and the Athi Plains—were selected for experiments. In general, all pastures were deficient in sodium and chlorine (the constituents of common salt) compared with good British pastures, and all except Naivasha were also low in phosphorus. At Molo the deficiency in phosphorus was as great as in parts of South Africa, where it causes disease in cattle.

The feeding of minerals to dairy cows had such a good effect on the cow's health that an animal receiving minerals could be told at a glance, even at a distance, by its sleek and glossy coat and its condition from the "control" cows, with their staring coats and thin, anæmic look.

Stronger Calves.—The calves of the mineral-fed group were considerably larger and stronger at birth. The mixture used consisted of two-thirds bone meal, one-third salt and a trace of potassium iodide. Each cow was given about two ounces per gallon of milk.

Sheep received the same mixture. The quantity of the wool was increased without any apparent loss of quality. This is an important point, because in Australia it has been found that where pastures are improved by using phosphatic manures the weight of the fleece is increased, but at the same time the quality deteriorates.

Feeding experiments carried out in the rich pastures of Naivasha gave no significant increase in the growth of lambs or the yield of milk. It is only on poor pastures that mineral supplements give marked results.

Yield of Pastures Doubled.—Dr. J. B. Orr, Director of the Rowett Institute, believes that there are vast areas throughout Africa, Australia and other parts of the Empire where the yield of the animals grazing over them could be very greatly increased by the large-scale application of these Kenya results. It has even been stated that a combination of fertilisers, mineral supplements, and improved pedigree grasses could double the carrying capacity of the Empire's grasslands.

Each part of the Empire, of course, has a different aspect of the question to grapple with. Dr. Orr's team has shown that mineral difficulties are, broadly speaking, of two kinds. Where hot, dry weather brings droughts, as in parts of Kenya, South Africa and Australia, phosphorus is the missing element, whereas in areas of high rainfall such as Scotland and the Falkland Islands the shortage is generally of calcium.

In Kenya soils, the report says, "phosphorus appears to be the limiting factor for the growth of good pasture." The application of phosphorus not only increases the bulk of the pastures, but tends to keep them green and succulent in times of drought.

Australian and New Zealand Work.—Recent work at the Waite Institute in Australia has shown that the transpiration of plants (*i.e.*, the evaporation of water from the leaves) is greater on phosphorus-poor soils than on those rich in this element. This suggests that phosphatic fertilisers would actually tend to conserve moisture in times of drought.

The story of "Nakuruitis," a wasting disease of cattle grazing in the Nakuru district of Kenya, is told in this report. Iron salts, which make up for the lack of iron in the Nakuru district grazing, have been found to prevent the disease altogether. A very similar disease, "bush-sickness," which occurs in New Zealand, was discovered in 1918 by New Zealand workers to be due to lack of iron and is being largely eliminated in the same way.

A List of Plant Diseases Occurring in Southern Rhodesia.

(June, 1930, to May, 1931.)

Compiled by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

APPLE (*Pyrus malus* L.).
- Brown Heart. Physiological.
- Diplodia Canker *Diplodia ? griffoni* (Griff. & Maubl.) Sacc. & Trav.
- Glassiness. Physiological.
- Pink Disease *Corticium salmonicolor* Berk. & Bri.
- Russetting. Frost injury.

AVOCADO (*Persea americana* Mill.).
- Fruit Scab *Colletotrichum glœosporioides* (Penz.) Sacc. following *Physalospora perseæ* Doidge.

BARBERTON DAISY (*Gerbera jamesonii* Hook.).
- Leaf Blotch *Alternaria* sp.

BARLEY (*Hordeum* spp.).
- Black Rust *Puccinia graminis* Pers.
- Root Disease *Sclerotium rolfsii* Sacc.

BAUHINIA (*Bauhinia* sp.).
- Rust *Uromyces rhodesicus* Wakef. sp. nov.

BEANS.

Achery Bean (*Phaseolus lunatus* L. var.).
- Mosaic. Virus.

Dolichos Bean (*Dolichos lablab* L.).
- Mosaic. Virus.

Jack Bean (*Canavalia ensiformis* DC. var.).
- Mosaic. Virus.

SOYA BEAN (*Glycine soja* Sieb. & Zucc.).
Violet Root Rot *Helicobasidium purpureum* (Tul.) Pat. [*Rhizoctonia crocorum* (Pers.) DC: only].
Root Disease *Macrophomina phaseoli* (Maubl.) Ashby.

Berlinia spp.
Branch Rot *Polystictus hirsutus* Fr.
Stump Rot *Hypoxylon malleolus* Berk. & Curt.
Trunk Rot *Lenzites repanda* Fr.

BRUSSELS SPROUT (*Brassica oleracea* L. var.).
Leaf Spot *Alternaria circinans* (Berk. & Curt.) Bolle.

CABBAGE (*Brassica oleracea* L.).
Black Rot *Bacterium maculicolum* McC.
"Sore Shin" *Rhizoctonia solani* Kühn.

CALLIOPSIS (Cultivated).
Mildew *Oidium* sp. (*Sphærotheca humuli* Burr. var. *fuliginea* Salm.).

CAMPHOR LAUREL (*Pittosporum undulatum* Vent.).
Leaf Spot *Pestalozzia guepini* Desm.

CARROT (*Daucus carota* L.).
Blight. *Alternaria circinans* (B. & C.) Bolle.

CITRUS.
GRAPE FRUIT (*C. grandis* Osbeck.).
Root Rot *Botryodiplodia theobromæ* Pat.
Stem & Twig Blight *Diplodia aurantii* Catt. following sunburn.
LEMON (*C. limonia* Osbeck):
Concentric Blotch. Undetermined.
Scaly Bark (*Psorosis*). Undetermined.
ORANGE (*C. sinensis* Osbeck).
Die-back *Macrophoma* sp.
Die-back *Sphæropsis* (*Haplosporella*) ? sp. nov.
Die-back following Root Disease *Periconia pycnospora* Fresen.
Dry Root Rot. Water injury and several fungi.
Fruit Blotch (storage). Low temperatures.
Oleocellosis. Physiological.
Mottle Leaf. Physiological.
Root Rot *Botryodiplodia theobromæ* Pat.

CLARKIA (Cultivated).
Foot Rot *Pythium ultimum* Trow.

COFFEE (*Coffea* spp.).
Leaf Blotch *Alternaria tenuis* Nees (group) following drought.

COTTON (*Gossypium* spp.).
Boll Rot *Rhizopus nigricans* Ehrenb.
Grey Lint *Acremoniella* sp.
Leaf Spot *Alternaria gossypina* (Thüm.) Hopkins comb. nov.
Leaf Spot *Alternaria macrospora* Zimm.
Leaf Spot *Mycosphærella ? gossypina* (Cke.) Atk.
Stem fungus *Pestalozina* sp.

CYPRESS (*Cupressus* spp.).
Damping-off *Pythium ultimum* Trow.
Root Rot *Diplodia* sp. and water injury.
Root Rot *Armillaria mellea*. (Fructifications not observed.)

DAHLIA (Cultivated).
Leaf Spot *Alternaria* (*solani* group).

EUCALYPTUS (*Eucalyptus* spp.).
Root Disease *Rhizoctonia bataticola* (Taub.) Butl. (Group A of Haigh*).
Root Rot *Sclerotium rolfsii* Sacc.

Gardenia sp.
Die-back *Hysterographium* sp.

GLADIOLUS (Cultivated).
Corm Rot *Penicillium gladioli* McCull. & Thom.
Leaf Spot *Epicoccum nigrum* Link. following insect injury.

GRAPE (*Vitis* spp.).
Leaf Spot *Cercospora viticola* (Ces.) Sacc.

GRASSES.
Brachiaria brizantha Stapf.
Rust *Puccinia* sp.
Hæmarthria fasciculata Kunth.
Leaf Spot *Phyllachora* sp.

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* Haigh, J. C. "*Macrophomina phaseoli* (Maubl.) Ashby and *Rhizoctonia bataticola* (Taub.) Butl." Ann. Roy. Bot. Gard., Peradeniya, xi. 3, 1930, Ceylon.

{ *Heteropogon melanocarpus* Benth.
{ *Heteropogon contortus* Roem. & Schl.
Rust *Puccinia versicolor* Diet. & Holw.
Setaria phragmitoides Stapf.
Rust *Uredo* of indeterminable rust.
Urochloa trichopus Stapf.
Rust *Uromyces leptodermus* Syd.

GROUND NUT (*Arachis hypogea* L.).
Leaf Spot *Septoglœum arachidis* Rac.

GUAR (*Cyamopsis psoralioides* DC.).
Stem Blight *Colletotrichum* (*atramentarium* group).

HOLLYHOCK (*Althea rosa* Cav.).
Concentric Leaf Blotch & Streak. ? virus.

JUTE (*Corchorus* spp.).
Damping-off *Corticium solani* Bourd. & Galz.

LARKSPUR (*Delphinium* spp.).
Mildew *Erisyphe polygoni* DC.

LETTUCE (*Lactuca sativa* L.).
Damping-off *Rhizoctonia solani* Kühn.

LUCERNE (*Medicago sativa* L.).
Dodder *Cuscuta medicaginis*.

MAIZE (*Zea mays* L.).
Black Rot. Sterile fungus (?·*Diplodia frumenti*).
Seedling Blight *Rhizopus nigricans* Ehrenb.
Seedling Blight *Penicillium* ? *oxalicum* Curie & Thom.
Seedling Blight *Aspergillus* sp.

MANGO (*Mangifera indica* L.).
Leaf Spot *Pestalozzia virgatula* Kleb.

MICHÆLMAS DAISY (*Aster* spp.).
Mildew *Erysiphe cichoracearum* DC.

PALM (*Phœnix* sp.).
Leaf Spot *Stagonospora* (cf. *kentiæ* Maubl.).

PEACH (*Prunus persica* L.).
Fruit Cracking. Drought.

PINEAPPLE (*Ananas sativus* Schult.).
Root Rot. Water injury and *Bacterium* sp.

PLUM (*Prunus* spp.).
Storage Rot *Rhizopus nigricans* Ehrenb.

POTATO (*Solanum tuberosum* L.).
Oedema. Physiological.
Spraing. Undetermined.
Tuber Rot *Fusarium solani* App. & Woll.
Tuber Rot & Wilt *Fusarium culmorum* (W. G. Sm.) Sacc. and *Bacterium* sp.

Protea angolensis Welw.
Leaf Spot *Coniothecium MacOwanii* Sacc.

RHUBARB (*Rheum raponticum* L.).
Crown Rot *Phytophthora parasitica* Dast. emend. Ashby.

RICE (*Oryza sativa* L.).
Ear Mould *Epicoccum* sp. (cf. *Nigrospora sphærica* (Petch) Sacc.).

SUNFLOWER (*Helianthus annuus* L.).
Root Rot *Sclerotium rolfsii* Sacc.

TOBACCO (*Nicotiana tabacum* L.).

Parasitic Diseases.
Alternaria Leaf Spot *Alternaria tabacina* (Ell. & Ev.) Hori emend. Hopkins.
White Leaf Spot. Associated with *Alternaria* (*tenuis* Nees group).
Black Stem Rot *Rhizoctonia* sp.
Brown Stem Rot *Phytophthora parasitica* Dast. emend. Ashby.
Stem Rot *Pythium* (cf. *debaryanum* Hesse) and *Fusarium* sp.

Virus Diseases.
Vein Necrosis. Probably ring spot virus.

Physiological Diseases.
Chlorosis. Nitrogen deficiency.
Fertiliser Scorch. Excess nitrate watered on seedlings.
Spray Injury. Brown spotting from copper-lime dust.

Curing Diseases.
Leaf Spot (Turkish) *Alternaria tenuis* Nees.
Moulds *Penicillium* spp. & *Aspergillus* spp.
"Must" *Oospora* sp.
"Saltpetre." Deposition of salts on leaf in fermentation bulk.

TEA (*Thea sinensis* L.).
Mouldy Seed *Penicillium* sp.

TOMATO (*Solanum lycopersicum* L.).
False Mildew. Virus.

WHEAT (*Triticum vulgare* L.).
Damping-off (in tins) *Rhizoctonia solani* Kühn.
Seedling Blight *Giberella saubinettii* (Dur. & Mont.) Sacc.

AMENDMENTS TO ORIGINAL LIST, JUNE, 1930.

CITRUS.
ORANGE (*Citrus sinensis* Osbeck).
Tear Stain *Colletotrichum glœosporioides* (Penz.) Sacc., following thrips injury.

COTTON (*Gossypium* spp.).
Internal Boll Rot *Epicoccum purpurscens* Ehrenb.
Leaf Spot *Phyllosticta gossypina* Ell. & Mart.

CUSTARD APPLE (*Anona reticulata* L.).
Leaf Disease *Phyllosticta* sp.
= *Ascochyta cherimolæ* Thüm.

Dodonæa viscosa L.
Mildew *Uncinula circinata* Cke. & Pk.

Eschscholzia sp.
Wilt *Fusarium* (? *oxysporum* var.).

GUAVA (*Psidium guajava* L.).
Fruit and Leaf Spot *Pestalozzia psidii* Pat.

Leucas martinicensis R. Br.
Wilt *Erysiphe cichoracearum* DC.

LOQUAT (*Eriobotrya japonica* Lindl.).
Anthracnose *Colletotrichum glœosporioides* (Penz.) Sacc.

MAGNOLIA (*Magnolia* sp.).
Leaf Blotch *Microdiplodia* sp., following drought.

OATS (*Avena sativa* L.).
Leaf Mould *Alternaria* (*tenuis* Nees group).

SNAPDRAGON (*Antirrhinum* spp.).
Collar Rot *Phytophthora parasitica* Dast. emend. Ashby.

TOBACCO (*Nicotiana tabacum* L.).

Parasitic Diseases.

Early Blight *Alternaria longipes* (Ell. & Ev.) Mason.

Flowering Parasite *Striga orobanchoides* Benth.

Undetermined Diseases. For "Crinkle" read "Crinkling."

ZINNIA (Cultivated).

Mildew *Erysiphe cichoracearum* DC.

Southern Rhodesia Weather Bureau.

MAY, 1931.

Pressure.—Barometric pressure was generally high in the south, but about normal in the north.

Temperature.—The temperature of the month was generally above normal. The highest temperatures were recorded in the south-west, where most stations were 4 degrees Fahrenheit above normal. Slight frosts were recorded at various stations towards the latter end of the month.

Rainfall.—The usual light winter rains were recorded in Zones E and F.

MAY, 1931.

Station.	Altitude	Pressure 8 a.m.	Temperature ° F.						Humidity, 8 a.m.		Precipitation.		
			Absolute.		Mean.			Diff. from Normal.	Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min.						
Bulawayo ...	4,440	872.2	87.0	43.0	78.5	51.5	65.0	+3.8	55.6	60	...	...	...
Gwelo	4,632	849.3	85.0	46.0	76.6	51.0	63.8	+3.8	55.2	65	.23	...	2
Riverbank ...	4,100	...	93.0	46.0	83.7	51.3	67.5	+4.8	54.8	60	...	...	...
Essexvale ...	3,828	...	96.0	41.0	84.7	48.3	66.5	+4.7	52.4	82	...	...	...
Gwanda ...	3,235	910.9	91.0	42.0	80.1	50.6	65.3	...	56.5	60	...	...	...
Mazunga ...	1,970	955.0	96.0	42.0	85.3	48.3	66.8	−0.8	59.0	66	...	...	...
Nuanetsi ...	1,630	...	...	...	...	...	...	...	...	...	...	...	...
Between Rivers	3,970	...	93.0	44.0	84.9	49.7	67.3	...	56.7	68	.16	...	1
Enkeldoorn ...	4,720	...	89.0	43.0	77.0	50.5	63.7	+3.2	56.6	65	.22	...	2
Gatooma ...	3,850	...	89.0	45.0	81.3	50.3	65.8	+1.4	57.0	56	...	...	...
Miami	4,090	...	86.0	46.0	77.5	52.9	65.2	...	58.4	61	...	...	...
Salisbury ...	4,865	858.6	83.0	45.0	75.9	51.3	63.6	+3.0	55.4	59	.31	...	4
Sinoia Citrus ...	3,830	...	87.0	40.0	80.5	49.2	64.8	...	56.3	65	...	...	...
Sipolilo... ...	3,900	...	87.0	46.0	77.6	53.5	65.5	...	58.4	65	.08	...	2
Juliasdale ...	6,070	...	79.0	43.0	67.5	48.3	57.9	+1.7	55.0	67	.44	...	6
Mtoko	4,210	...	84.0	51.0	76.0	55.1	65.5	...	59.9	75	.06	...	1
Shamva ...	3,170	...	89.0	46.0	81.4	51.5	66.4	+2.4	60.4	70	.01	...	1
Angus Ranch ...	2,300	...	94.0	50.0	82.4	57.4	69.9	...	59.1	66	...	...	...
Craigendoran ...	3,000	...	92.0	47.0	80.5	52.9	66.7	...	61.6	75	...	...	...
New Year's Gift	2,700	...	91.0	51 0	79.5	54.9	...	...	56.8	65	.07	...	2
Nyamasanga ...	5,080	...	...	...	...	...	...	...	...	...	...	...	...
Riverdene North	3,700	...	91.0	37.0	79.5	45.7	62.6	+1.8	53.9	77	.01	...	1
Stapleford ...	5,450	...	76.0	38.0	64.6	45.5	55.0	...	55.1	76	1.72	...	6
Umtali	3,677	...	...	...	...	...	...	...	...	...	...	...	...
Victoria ...	3,570	900.1	88.0	41.0	76.1	48.0	62.0	+1.6	56.5	67	...	...	...
Melsetter ...	5,060	...	...	...	...	...	...	...	...	...	...	...	...
Mount Selinda	3,520	...	...	...	...	...	...	...	...	...	...	..	...

Farming Calendar.

July.

BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry out repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

CITRUS FRUITS.

The harvesting of mid-season oranges should be completed early in the month; late varieties should be fit to export by the middle of the month. The dead wood should be broken and cut out of all harvested trees; this will minimise mechanical injury occurring with next season's fruit. Trees that are to be fumigated should have the lower lateral branches that touch the soil removed. Trim the trees until all foliage is just clear of the ground. The irrigation of late varieties must be continued and the cultivators kept going. Mark all trees when in fruit if the quality is bad; these may be cut back in August for top working to a good quality fruit. The soil of the early and mid-season varieties may be allowed to become fairly dry, for irrigation of the harvested trees may start an out-of-season growth which will enable pests to flourish and increase for the main spring blossoming flush.

CROPS.

Support agricultural shows, and add to your list of exhibits. Advertise your goods through the shows. Interested people will see them. If you require to make purchases of seed for next season, judge by the exhibits on the show what grower can best supply your needs, and place your orders accordingly. Attend the shows and go there to learn all you can about your business, not merely to have a good time. Seed maize previously selected in the field should be butted and tipped and hand shelled. Keep the butt and tip grain for check-row planting by hand. Do not over-irrigate winter crops, and do not irrigate when the wind is from the south, as this often means frost at this time of year. Troublesome weeds, such as darnel grass or drabok, may be removed from cereal crops by hand. Ploughing should be pressed on with, and maize stalks and roots of maize and other trash from the crop should be collected and burned very thoroughly. A land littered with unburnt and unrotted stalks and roots cannot be brought to a suitable tilth for planting and subsequent cultivation. Silage and sweet potatoes and other succulent feeds will have come into general use now, the potatoes being lifted from the land as required. The application of phosphatic fertilisers which are to be ploughed or harrowed in can be begun. Take the opportunity, during this and the next month or two, of inspecting all boundary and paddock fencing and gates, and effect repairs where required. Give a coat of paint to implements, wagons and carts. This protects the woodwork from rotting and the iron from rust.

DAIRYING.

This is one of the coldest months of the year, and milk production as a rule is low. Those cows which are being milked should receive a full winter ration of succulents (ensilage, pumpkins or majordas), hay and concentrates. Milking cows should either be under shelter at night or kraals should be sheltered against cold winds. The old adage, "Shelter is as good as a meal," should be remembered throughout the winter months.

No difficulty should be experienced in producing first-grade cream at this time. In cold, windy weather due precautions should be taken to ensure that the milk when separated is not below 90 degrees.

Most cheese-makers cease their cheese-making operations at the end of the month, as the milk generally not only is scarce, but begins to be deficient in butter fat. Cheese in the store-room should be carefully watched, as cheese mite is likely to appear on old mature cheese. In order to prevent the undue drying out of the cheese, the floor of the cheese room should be sprayed with water from a watering can.

Butter-making is sometimes difficult because of the low temperature of the cream. The temperature should be raised by immersing the can in warm (not hot) water until churning temperature is attained.

DECIDUOUS FRUITS.

Pruning must be continued, and if possible completed this month. The planting of all varieties is best if done now. Add a liberal amount of water at planting time, then cultivate the basins. Sufficient moisture will be thus retained to keep the newly planted trees going until they start active growth. Repeat waterings when necessary. If trees arrive from the nurseryman in a dry and withered condition, immerse them in water for twelve or more hours until they regain turgidity; then plant. Running water is best. Keep cultivators going. It will be advisable to irrigate all trees towards the end of the month.

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family suffer from cabbage louse and Bagrada bug during July. Young louse-infested cabbage should be sprayed regularly with a forceful stream of water to dislodge the insects; or if this fails, spray with tobacco extract and soap. The Bagrada bug is difficult to control. Strong tobacco wash and soap, resin wash or an oil spray may be effective, especially against the younger stages. Daily hand picking is useful. Keep plants growing vigorously.

Fig.—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

Maize Beetle.—Infested lands to be thoroughly ploughed throughout the winter.

FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

VEGETABLE GARDEN.

Sow turnips, peas, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

FORESTRY.

Care should be taken to protect all plantations from fire by hoeing or ploughing belts round them and burning any grass likely to be dangerous.

Cuttings of various deciduous trees may be taken and struck in nurseries. Continue pricking out conifers into tins or beds. In preparation for early planting in case the season is favourable, limited sowings of tree seeds may be carried out. If labour is available, preparation of land for planting to be taken in hand.

GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

POULTRY.

With the cold weather that we generally have in July, the birds should have extra food, i.e., barley or maize, if the supply of eggs is to be continued. A mixture of stewed linseed and bran should be given to the birds, warm, the last thing before they go to roost. This gives them a little extra food during the long and cold hours of the night at this time of the year and maintains the body heat. A certain amount of shelter is also necessary to protect them from the cold winds. Grass wind breaks about 3 feet high on the windward side of the run are sufficient. Remember that no chickens should be hatched after August; those hatched later take much longer to develop than those hatched before August, and they are usually stunted, weakly and unprofitable. Each month the young stock should be gone through and graded; anything that does not promise to be good should be got rid of. As the hatching season draws to a close, the breeding stock, if not carefully watched and treated, will become run down, and infertile eggs and weak chicks will be the result. Watch the breeding stock carefully and handle them occasionally; if they feel thin and light or the flesh is not hard but flabby, give extra food and more scratching exercise. The male especially should be well looked after and given a meal on three or four days of each week by himself; in addition, he should have some raw meat as often as possible. Good hatching and strong, healthy chicks are wanted right up to the end.

Turkeys should now be in full lay. Never disturb the hens when they are sitting. They are very sensitive and nervous, and unless left mainly to themselves, are apt to desert the eggs or break them. It is recommended that turkey chicks be reared by hand; the hens are poor mothers, they are clumsy, drag their chicks all over the place, and do not feed them as well as an ordinary hen does. The main thing is to keep the young turkeys warm, give them plenty of fresh air, thick separated milk and chopped onions or onion tops.

STOCK.

Cattle.—The bulls may again be put into the herd at the end of the month. Watch for any unthrifty cattle and get them into the home paddock and feed them before they become really poor. The value of a good provision for winter feed will be apparent now. Except under purely ranching conditions winter feeding should be general. Where areas have been properly reserved for winter grazing these should be in use now. The treatment of the dairy herd should be continued on the same lines as in June.

Sheep.—Vleis should now be fairly dry and may be utilised. There is, however, always the danger of internal parasites, and, where feed or grazing can be provided elsewhere, it is better to avoid vleis.

VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none is looked for or desired this month. Most stations record an average of .01 to .3 inch over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

August.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned, and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather, the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents.

Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal.* Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis, or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and, if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farmyard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillars. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, 1¼ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given

for potatoes with the addition of ½ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

Bv the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know, are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should

be treated every week in one of the following ways:—(1) Thorough soaking with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible, and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

Notes from the "Gazette."

"Gazette" Date.	Items.
	IMPORTATION OF CITRUS TREES.
12.6.31.	Government Notice No. 369 permits the importation without restrictions of citrus trees from the territory of the Mozambique Company, provided they are the product of that territory.
	"GAME AND FISH PRESERVATION ACT, 1929."
22.5.31.	Government Notice No. 316 prohibits the setting of springs, gins, traps, snares or any other contrivance for the capture or destruction of game and other animals and birds on any land without the consent of the owner or occupier.
	AFRICAN COAST FEVER.
22.5.31.	Government Notice No. 318 releases the farm Enhoek, in the Melsetter Native District, from all restrictions.
	SOUTHERN RHODESIA TOBACCO BOARD.
22.5.31.	The following have been appointed members of the board with effect from 6th June, 1931:— Messrs. J. A. D. Hawksley (Chairman), J. M. Bowman, Major L. A. M. Hastings, A. C. Henderson, E. J. Dawson, O. C. Rawson and F. Cooksey. (G. N. No. 336.)
	FOOT AND MOUTH DISEASE.
29.5.31.	The removal of hay, forage and fodder is prohibited from any farm within the following native districts, viz.: Bikita, Gutu, Chilimanzi, Victoria, Ndanga, Chibi, Selukwe, Belingwe, Charter, Gwelo and Gwanda; provided, however, special permits may be issued for such removal by the District Veterinary Surgeon under such conditions as may be deemed necessary to impose. (G. N. No. 348.) The importation into Nyasaland of all animals, carcases, hides, skins, hoofs, horns, hair, wool, litter, dung and fodder from Southern Rhodesia is prohibited. Arrangements have been made for all motor cars to be examined and disinfected at the border between Southern Rhodesia and Nyasaland.
	LAND TAX AMENDMENT ACT, 1931.
12.6.31.	The Act, as amended, is suspended until further notice from the 15th May, 1931. (G. N. No. 16.)

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 581. Leguminous Crops for Stock and Soil Improvement in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 603. The Production of Maize in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 724. Ploughing by Tractor, by A. W. V. Crawley, M.E., F.G.S.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 750. Cotton in Southern Rhodesia—Hints to Growers, by G. S. Cameron, Empire Cotton Growing Corporation.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 777. Some Aspects of Cost of Production Studies in Agriculture, by Arthur G. Ruston, D.Sc., Department of Agriculture, Leeds University.

No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 783. Agricultural Costings at the Gwebi Farm—Fattening for Beef, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.

No. 794. Some Further Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
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No. 804. Locusts in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

POULTRY

No. 547. Rhodesia Egg-Laying Test, 1st April, 1924—2nd February, 1925, by H. G. Wheeldon.

No. 622. Ducks on the Farm, by H. G. Wheeldon.

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No. 795. The Turkey, by G. H. Cooper, Assistant Poultry Officer.

No. 803. Geese, by G. H. Cooper, Assistant Poultry Officer.

The following pamphlets can be obtained from the Poultry Expert upon application :—

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Cold Weather: Treatment of Fowls in, by A. Little, Poultry Expert.

Tuberculosis, by A. Little, Poultry Expert.

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Respiratory Diseases, by A. Little, Poultry Expert.

Selection and Preparation of Fowls for Exhibition, by H. G. Wheeldon, Poultry Expert.

The Close of the Hatching Season and After, by H. G Wheeldon, Poultry Expert.

METEOROLOGICAL.

No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 436. The Possibility of Seasonal Forecasting and Prospects for Rainfall Season 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.

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No. 532. The Short Period Forecast and Daily Weather Report, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 542. Review of the Abnormal Rainfall Season 1924-25, by C. L. Robertson, B.Sc., A.M.I.C.E.

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MISCELLANEOUS.

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No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.

No. 479. Quinine Prophylaxis in Malaria, by A. M. Fleming, M.B., C.M., F.R.C.S.E., D.P.H.

No. 518. Locusts as Food for Stock, by Rupert W. Jack, F.E.S.

No. 549. Ochna Pulchra Berries, by A. W. Facer, B.A., A.I.C.

No. 554. Pisé-de-Terre, by P. B. Aird.

No. 569. Education of Children of Farmers in Southern Rhodesia, by R. McIntosh, M.A.

No. 574. Brick-making on the Farm, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.

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No. 699. The Preservation of Farm Beacons, by L. M. McBean, Acting Surveyor General.

No. 702. Book-Keeping on the Farm, by T. J. Needham, Acting Accountant, Agricultural and Veterinary Departments.

No. 707. Wood-Charcoal in Southern Rhodesia, by T. L. Wilkinson, B.Sc., Assistant Forest Officer.

No. 733. Jam-making, by Miss D. Bosman, Home Economics Officer, Division of Agricultural Education and Extension, in "Farming in South Africa."

No. 764. How to Make Use of the Fencing Law.

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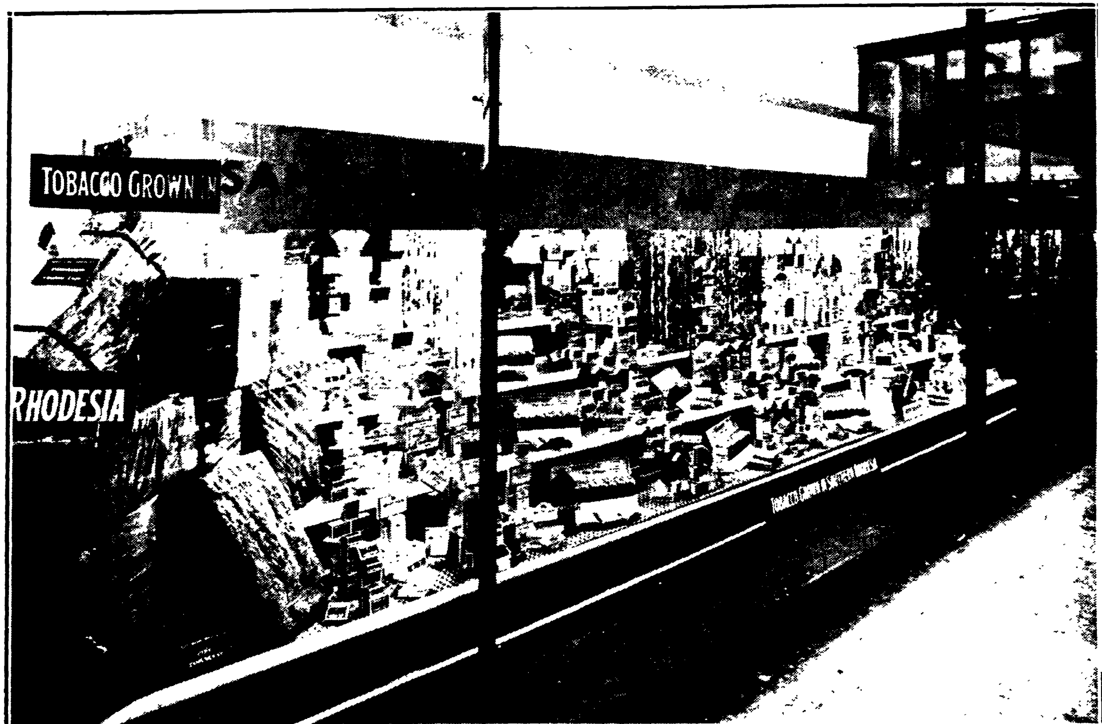
Twelve Simple Rules for the Avoidance of Malaria and Blackwater.

Summary of the Game Laws of Southern Rhodesia



The Empire Marketing Board's shop at Birmingham occupied by Southern Rhodesia, 4th to 16th May, 1931, showing the tobacco display.

THE RHODESIA

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Publicity for Rhodesian Tobacco.—We feel that more than a passing reference to the very fine display of Rhodesian tobacco at Birmingham during this Colony's tenancy of the Empire Marketing Board's shop in May is needed, and for this reason we reproduce on the opposite page another photograph of the shop from a different view-point to that shown last month. Our frontispiece picture in the July issue of the Journal showed the High Commissioner at the opening of the exhibition presenting a casket of Rhodesian tobacco to the Lord Mayor of Birmingham; the accompanying illustration presents an exterior view of the shop and shows the striking effect achieved in the window display.

It is interesting to note that "Tobacco," the influential British trade journal, devotes two and a half pages of its space to a description of the exhibition and in the course of

the article states: "It was an ambitious venture on behalf of the tobacco planters and manufacturers, for the whole of the three deep windows of the High Street section of the premises were taken, together with the main interior, which had double display counters on each side of the main entrances. The effect was clean, neat, colourful, and attractive, and served to show to the smoking public the variety of Empire goods which come from the land which Cecil Rhodes made famous."

Later on in the same article we notice the following remarks by Mr. G. Singleton of the well-known firm of Messrs. Singleton and Cole, Ltd.: "he had had a long experience in leaf tobacco and he maintained that the present growing and marketing of Rhodesian tobacco was equal, if not better, than tobaccos grown in other parts of the world. Of course tobacco grown in South Africa, even from the same seed, was rather different from tobacco grown in America. At the same time the result was very pleasing, and the British public were gradually getting to like the productions of South Africa, and that was all to the good."

Apropos of these latter remarks it is interesting to quote the following from an editorial article in the same journal on force of habit. It is stated "If all American leaf ceased to be produced to-morrow, let us say owing to the prohibition policy of the U.S.A., we should be dependent upon other supplies. An experienced manufacturer in a chat with a representative of 'Tobacco' the other day, said that in such a contingency the smokers of Great Britain would get so accustomed to Rhodesian tobacco in two years that they would then refuse the tobacco from the Carolinas as not suited to their taste." In support of this statement the writer of the article refers to the decided way in which, during the war, smokers of "Turkish" cigarettes veered round to the "Virginian" variety. They did so because supplies of Oriental tobacco were cut off. In South Africa and Southern Rhodesia we have of course direct evidence of a similar nature in the way smokers' requirements are now met almost entirely by home grown tobaccos.

These remarks bear a significance which it is well to take note of. They are certainly sufficient to justify every effort being made to increase the sales of Rhodesian tobacco

in the United Kingdom and indicate that providing the standard of quality is maintained and production is adjusted to requirements, there is a very hopeful future for our product in this immense market.

Cattle of Southern Rhodesia.—We publish elsewhere in this issue of the Journal provisional figures of the cattle population of the Colony as at 31st December, 1930. It will be seen that European owned cattle number 909,526 representing, for the first time since 1925, an increase over the previous year's total. The peak year was in 1925 when the total was 1,006,086, the figures for subsequent years being 991,216 in 1926; 956,522 in 1927; 905,383 in 1928; and 902,163 in 1929. The main increases in 1930 are in "yearlings, oxen or bulls," which account for 8,984 of the increase, "other cows" for 7,020, "all calves under 1 year" for 5,458, and "cows regularly milked" for 2,166. Decreases are recorded in "untrained oxen" of 9,156, and in "trained oxen" of 6,222. A slight increase of 453 is reported in pure bred cattle, the total for 1930 being 15,297.

Native owned cattle continue to increase and the total is now 1,558,075 representing an addition of 62,272 head during the year. These cattle have shown varying increases from 2.3 to 14.4 per cent. since statistics were first taken in 1917 when the total was 551,632.

The total number of cattle in the Colony is now 2,467,601, constituting a record.

Debates on Farming Matters.—We note that the Glendale Farmers' Association has decided to devote a portion of the time at their meetings to a discussion of farming matters, and that in July an interesting debate took place on the subject of cross ploughing after a green manure crop had been turned in. This idea has been suggested before in this Journal and it is one that could well be adopted by other associations. The interchange of experiences and the expression of views which such a discussion brings forth must be of benefit even to the oldest inhabitant of the district. Farming in this Colony is not yet reduced to a formula, and

improved methods of performing different cultural operations are constantly being discovered. No better means of disseminating information of this nature and stimulating the desire to practise good farming could be found. Good farming must be economical and farmers must know exactly what each operation costs. It is therefore essential that some system of accounting or book-keeping be adopted which will at any time reveal the financial results of a particular operation. A discussion of the matter would probably induce these farmers—and there are many in the Colony—who do not keep accurate costs of their operations to do so. There are many subjects which could be discussed at such gatherings apart from purely farming matters, but for a beginning there is ample scope in the consideration of "bread and butter" items such as was discussed at Glendale.

We trust that the example of this Association will be followed throughout the Colony.

The Show Season.—It is good to note that despite the presence of foot and mouth disease in our midst and an era of general economic depression which has hit the farmers of this Colony sorely, agricultural shows are to be held during the next few months at Umtali, Bindura, Rusape, Gwelo, Salisbury and Bulawayo. The show committees feel that it would be bad policy to break the continuity of this important annual event and to submit to fortuitous circumstances of the nature mentioned. In this they are perfectly justified, and we trust that farmers will support their show loyally by exhibiting produce and by their presence on the ground at due date. We also trust that the general public will attend the shows in greater numbers than ever and help to make them a financial success, for it should be remembered that the prosperity of the Colony is indissolubly bound up in the well-being of the farming industry.

Great strides have been made during the past few years in the usefulness and attractiveness of our larger shows. They can claim to represent truly the status of the agricultural industry to-day and the remarkable progress which, in the face of great difficulties, has been made in a short span

of time. Rhodesians are justly proud of this progress and feel that although at the moment times are difficult, nothing can prevent that development of which the present is but an indication.

Empire Tobaccos.—A further example of the good work which the Empire Marketing Board is doing to popularise Empire tobaccos is provided by the Board's latest poster frame set, photographs of which were sent to us recently. The set is composed of five coloured posters. It appeared during June on the Empire Marketing Board's special poster frames in London and nearly 500 towns in England, Scotland, Wales and Northern Ireland.

While the three large posters limit themselves to describing, against a striking background, the virtues of Empire tobaccos, the smaller ones record some interesting facts. One tells how the imports of Empire tobaccos have increased from 2¼ million lbs. in 1913 to 35½ million lbs. in 1930 and shows that 15 per cent. of the tobacco entering the United Kingdom is now Empire grown; the other gives the average quantities of tobacco imported from each individual Empire country engaged in its cultivation during the period 1927-1930. Southern Rhodesia figures third on the list with 7½ million lbs., Nyasaland leading with 12¼ million lbs., followed by India with 10¼ million lbs.

We certainly cannot complain that Southern Rhodesia tobacco is unknown to the British public. It now remains for the tobacco interests of this Colony to follow up the efforts of the Empire Marketing Board and of our High Commissioner's Office in London and see that the publicity gained is turned to good account.

Tobacco Statistics.—The *Government Gazette* of the 10th July contained a notice calling upon growers or prospective growers of tobacco to render particulars relating to plantings and the crops reaped, the use of artificial and other fertilisers for tobacco, and the number of tobacco barns in use. These particulars apply to the actual plantings for the season 1930-31 and the intended plantings for the

ensuing season. Thirteen hundred and one forms have been sent to known and possible growers of tobacco and these were returnable to the Government Statistician by the 1st August. It is obligatory on every grower to supply the information called for and failure to comply renders the delinquent liable to a fine of £50.

It should be understood that the information is sought in the interests of the growers themselves and we trust there will be no undue delay in returning the completed forms at due date. At the present juncture there are indications of a material increase in the production of tobacco during the coming season and it is thought there may be a recurrence of the unfortunate circumstance of 1927-28 when tobacco was produced far in excess of market requirements with disastrous results to growers. It may be necessary to introduce measures to prevent a repetition and the acquisition of the information sought will help very materially in arriving at a correct appreciation of the position as it exists to-day.

In the meantime we would take this opportunity of reminding growers that tobacco is a specialised crop and that only by unremitting care and attention can leaf of requisite quality be produced.

Wheat in Southern Rhodesia.—In order to encourage the growing of wheat in the Colony the Government has approved of a rebate or refund of the customs duties on wheat imported by a *bona fide* miller or milling company when the wheat is used and blended with wheat grown and produced in the Colony in the process of manufacture of flour or meal. The rebate is on the basis of the duty on four bags of imported wheat to every bag of Southern Rhodesia wheat purchased and ground into flour or meal in this Colony. In return the millers undertake to pay a minimum price of 25s. per bag to the local producer, a price which should permit of a fair margin of profit to the grower. This arrangement supersedes that entered into in 1928 whereby the millers paid a guaranteed price of 28s. per bag for local wheat.

The fixation of price during the past three years has certainly stimulated production which in 1930 amounted approximately to 14,000 bags as compared with 7,025 bags in 1928. In spite of this material increase in production the Colony is far short of supplying its requirements of wheat and flour, which last year totalled 19,098,395 lbs. of which 14.6 per cent. only was grown in Southern Rhodesia.

We believe that bread made solely from Southern Rhodesia flour has been found to be quite satisfactory, and in view of the fact that there are extensive areas where wheat can be grown successfully as a winter crop there would appear to be no reason why the large sum of money sent out of the Colony annually for supplies of wheat and flour should not be reduced appreciably if not eliminated entirely.

It should be mentioned that experiments are being carried out at the Government farm, Marandellas, with the object of breeding a strain of wheat which will give a better yield than existing types and at the same time possess the requisite milling and baking qualities.

An article on the growing of wheat appeared in the issue of this Journal for October, 1925, and was reprinted as bulletin No. 561.

Marketing of New Zealand Dairy Produce.—In view of the introduction of legislation in this Colony to control the dairy industry, it may be of interest to enumerate some of the main features of the New Zealand Dairy Produce Control Act.

This Act was passed in 1923, and, after an affirmative vote of producers, the Control Board, consisting of nine producers' representatives (three of whom retire annually), two Government nominees and one representative of merchant and proprietary interests, was established. For the season of 1926-1927, the third year of the Control Board's operations, all butter and cheese was pooled, according to grade, and sold through the Board, minimum prices being fixed for the British market. Owing to disagreements, this innovation was discontinued, in the following year, in favour of a system of limited control, based on the licensing of exporters; this latter system is still in operation. Recent dis-

cussions, however, show that a strong section of opinion favours another advance towards centralized marketing with, at first, a system of voluntary pooling.

The cause of the failure of the first pooling and price-fixing experiment is still a matter of controversy, but it has been attributed to the fixing of prices by the London distributing agency for the sale of produce to wholesalers at a level which could not be maintained on account of alternative sources of supply.

Under the present system, dairy companies are permitted to export, under licence from the Ministry of Agriculture, provided they agree to ship and to insure under the direction of the Board, and to store the produce in Great Britain in warehouses approved by the Board, which takes elaborate steps to regulate supplies. The Board is financed by levies on the butter and cheese exported, the present rates being 3½d. and 1¾d., respectively, per cwt. The income of the Board in 1929-30 was £40,000. An efficient inspectorate is in operation, and a small publicity staff is maintained, which also does a certain amount of market investigation. Approximately £15,000 per annum is spent on advertising, the Board holding the opinion that "it is absolutely necessary to make New Zealand produce more widely known." It was recently decided to form an advisory committee in London, representative of the Board and of the London importers, to deal with special marketing problems as they may arise, as well as to develop publicity and sales.

At the time of writing, the Board which is to administer the Dairy Industry Control Act in this Colony has not yet been appointed, but when this is accomplished we hope to publish an article by the Acting Chief Dairy Expert describing the main features of the measure and its operation.

Notes from the Veterinary Laboratory.

By Ll. E. W. Bevan, M.R.C.V.S.,
Director of Veterinary Research, S. Rhodesia.

"History proves to us that a nation cannot live by its towns alone; it tells us that the virile and progressive nation is that which can keep pace with the modern industrial world and at the same time support a contented and flourishing peasantry."—Morton.

Nutrition.—In the past it was frequently stated by enthusiasts and those having land to sell, that Southern Rhodesia was pre-eminently a stock-raising country; but time and painful experience have indicated the inaccuracy of this contention. For, alas, after forty years' European settlement the pastoral industry in this Colony is in a lamentably backward condition. Our cattle are not only few in quantity, but poor in quality. The majority of them are quite unsuitable for overseas markets which require a constant supply of animals of uniform type and quality, and could not hope to compete with those from other parts of the world. This is largely due to plague, pestilence and famine, which have constantly handicapped the industry, but chiefly famine. For it has to be admitted that in most parts of the Colony, for four months every year, our cattle practically starve upon the natural grasses which are almost devoid of nutriment.

But if Southern Rhodesia is not pre-eminently a stock-raising country at the present time, there is reason to hope and believe that science and practice may make her so. Moreover, she is not alone in the difficulties against which she has to contend, many of which are encountered in other parts of the Empire, as is shown in an "Index to Research

Work on Animal Nutrition throughout the Empire," compiled at the Imperial Bureau of Animal Nutrition. This document reveals the fact that information has been collected by special correspondents in as many as forty-one countries, and indicates that all branches of this all-important subject are being carefully and scientifically investigated. Southern Rhodesia is collaborating in this research and will benefit not only by her own efforts but from the experience of others.

Already practical results of the greatest value have been derived from research in this direction, as for example, the work of Theiler and his collaborators in connection with Lamziekte from which our knowledge of the importance of phosphatic compounds in the diet of live stock has been derived. Those who have tried the addition of bone-meal in the rations will testify to the practical value of this scientific research. In New Zealand, also, several diseases have been found to be due to deficiency in pastures, as for example, "bushsickness" in sheep and cattle which is characterised by progressive anaemia and emaciation. This has been found to be due to iron starvation, and the administration of certain soluble iron salts both cures and prevents the onset of the disease. There is also another disease called "Waihi disease" in which "the animals have a stilted gait which simulates cramp and rheumatism, the forelegs being specially affected. The hoofs grow abnormally long, nodular enlargements appear on the ribs which on post-mortem examination are found to be soft and spongy. The animals become weak and emaciated. The disease is prevalent on light soils the herbage of which has been depleted of its nutritional value by continued grazing without cultivation or manuring. The application of basic slag to the soil has proved valuable in diminishing the incidence of this complaint. No data on analysis of the pastures are available. The description of the disease, however, and the fact that it is prevented by the administration of bone meal or Parrish's Chemical Food (syrup of phosphate of iron), or top-dressing with superphosphates, suggest that it is due to a deficiency of phosphorus. It is interesting to note that the fact that top-dressing with superphosphate prevented this disease, helped to popularise the practice of top-dressing."

The above quotation is taken from a book "Minerals in Pastures and their relation to Animal Nutrition," by Dr. J. B. Orr of the Rowett Research Institute, Aberdeen, who at the request of a sub-committee of the Civil Research Committee of the Cabinet, brought together the available information on the subject with the object of having it circulated throughout the Empire to various officials and research workers interested in the subject.

It is interesting to note that one of those who sat at the feet of Dr. Orr at Rowett Institute is conducting experiments in pasture research in this country, so that Southern Rhodesia is in close touch with this movement—which is a good example of team-work in science—and she will probably be one of the first to derive benefit from it. In the last issue of this Journal a report was published on "Pasture Research in Southern Rhodesia," which, in the opinion of the writer, who was present at the demonstration given by Mr. Husband, the Chief Chemist, might have been amplified with advantage. It is true that experiments conducted on the sand veld farm at Marandellas are in their early stages, but already deductions of practical value can be drawn from them. The improvement in the grazing value of veld treated with various fertilisers is already noticeable, but perhaps the most remarkable result is to be seen in the pastures which have received no other treatment than stumping and the judicious mowing of the grasses at the right season. Any system which will make "two blades of grass grow upon a spot of ground where only one grew before," and will conserve adequate nutriment for our cattle during the winter, will prove of the greatest value in this Colony. Notwithstanding the ridicule recorded in *Hansard*, it will probably prove the greatest factor in placing our pastoral industry on a sound foundation.

Apart from the fattening of our stock we have to consider the reverse, the appalling wastage which results from lack of nourishment or mal-nutrition. It is probable that more animals have died in this Colony from sheer starvation—which is locally called "poverty"—than from all the plagues and pestilences of which it has had more than its full share. Not only does starvation destroy an animal by slow torture, but it renders it susceptible to diseases which might otherwise be resisted. In a lecture on "The Development of the Science

of Nutrition in Relation to Disease," recently delivered by Dr. Orr, he says "The information obtained from these observations warrants us accepting, as a working hypothesis, the view that in animals suffering from even minor degrees of deficiency, resistance to organisms normally present in the body may be reduced, and hence bacteria, which in an animal on a perfect diet might remain non-pathogenic, find in the abnormal tissues and fluids of the host a favourable medium in which their activities can give rise to the specific signs of infection." This is commonly seen in this Colony in diseases caused not only by bacteria, but other parasites, for example, the verminous infections of sheep, or trypanosomiasis of cattle.

Foot and Mouth Disease.—Some facts and figures of practical importance in connection with this disease may prove of interest. This is one of the diseases caused by a filterable virus, that is to say, the cause of it—whatever it may be—will pass through porcelain filter-candles of very fine texture or even collodion membranes. It is so minute that it cannot be viewed under the microscope and thus the inability of local workers to diagnose the disease from the examination of blood smears is to be understood. The study of this virus has recently been simplified by the discovery that guinea-pigs can be infected by inoculation with material from the typical vesicles of cattle. Animals weighing about 350 g.m. which are gaining in weight are most susceptible; young animals or older ones in poor general condition do not react well. Inoculation of guinea pigs therefore does not always result in infection, but when once the disease is established in them its transmission from pig to pig becomes more certain. It is rather for the study of the disease than for diagnostic purposes that these small animals are used, and many important facts in relation to the virus and the immunity against it have been determined in this manner. It is obviously easier and cheaper to carry out experiments on guinea-pigs than upon cattle and sheep, and in some laboratories situated in cities, research into the disease would not be possible on larger animals. Rabbits are also susceptible to artificial infection when inoculated with virus from guinea-pigs, but are more difficult to infect with virus direct from cattle. Attempts to infect them by feeding them upon heavily

infected bran failed. Rats, being suspected as natural disseminators of the disease were tested but were found to be highly resistant to cattle virus. Birds were also regarded with suspicion, but Stockman and Minett inoculated 34 fowls without producing any clinical effects, and of 12 fowls fed with virus only three were found to contain it in their faeces between 10 and 16 hours after feeding. They also found the sea-gull, martins, and sparrows insusceptible. These observations are of interest in view of the theory that the local disease has been introduced by storks. The horse is not susceptible and dogs and cats only exceptionally so. Infection in man has been recorded, but is a comparatively rare occurrence.

As in horsesickness, so in foot and mouth disease there appear to be different strains of virus, and immunity against one is not necessarily complete against another. Immunity may be localised or general: the former is brief, but the latter is more lasting, in some circumstances it is retained up to two years after recovery from infection. Various methods of conferring immunity artificially have been tried. The serum of hyper-immunised animals has been used to convey passive or transient immunity to animals in danger of infection. Simultaneous infection of immune serum and active virus has been adopted with some success in Germany. This method gives rise to the disease and can only be used where infection already exists. Vallée, a French investigator, has used as a vaccine, virus attenuated for formalin, but as with all formalised vaccines this method has its disadvantages. At present a satisfactory method of protecting animals by inoculation has yet to be found.

In sick cattle the disease commences with an elevation of temperature and the virus is then present in the blood, later it is found in the vesicles or blisters which appear on the tongue, lips, gums, palate, udder and feet. The fluid within these vesicles is at first highly infective, and as they rupture contaminates the saliva and nasal discharges or ground upon which the animals stand. In this way infection is spread.

The virus is easily destroyed by some agents, but is highly resistant to others. For example light and heat have a destructive action upon it: at 98 degrees Fahr. it rapidly

becomes non-infective—which is fortunate. But it is resistant to cold, and low temperatures actually preserve it—which is not so fortunate. It survives for long periods in meat carcases, particularly in the bone marrow. It was found that the mysterious appearance of the disease in Great Britain could be attributed to the carcases of infected animals from the continent. Also in an outbreak in California infection was detected on a "pig ranch" and was definitely traced to Argentine meat scraps. At freezing temperature the blood of a beef carcase has been found to contain the virus after forty-two days and the bone marrow after seventy-six days. "The processes of dry salting and wet salting of bacon carcases fail to destroy the virus contained in the bone marrow, this tissue having been found infective after forty-three days and not after seventy-six days. One very practical point . . . is the great facility with which pigs were found to become infected when fed on crushed bones containing virulent marrow. This occurred on seven occasions out of nine."—Minett. It should be emphasised, however, that the blood is most infective during the early febrile stages of the disease—and that the infectivity of the muscular tissue apparently depends upon the blood contained in it. It is thought that the acidity of the muscle juice after death is capable of killing the virus which is very vulnerable to acids.

"Valuable indirect evidence on the problem of transmission has been afforded by laboratory experiments on the viability of virus dried on various materials. At the Lister Institute the following results have been obtained. A small drop (0.02 c.c.) of guinea pig vesicle fluid diluted 1 in 5, was allowed to dry on fabrics, fodder, etc., which were stored at room temperatures for varying periods. The viability of the virus was tested by soaking the material in a small quantity of physiological saline and inoculating the liquid into guinea-pigs. Virus dried on silk fabric was infective for one but not two weeks; on woollen fabric it was infective for two but not for three weeks; on hay virus remained infective for as long as fifteen weeks, on bran for at least ten weeks; on cow's hair for four weeks, on sand for two weeks. The American Commission which worked at Strasbourg and at Alfort have reported the survival of virus on hay and on sand, under field conditions, for 25-30 days. In an experiment

at Pirbright, hay was contaminated with saliva from cattle during the acute stage of the disease and stored in sacks. One bovine was infected by feeding hay that had been stored for four weeks.

"Another matter of interest is the infectivity of saliva. Recently Waldmann and Reppin have reported that in cattle the saliva may contain virus as early as nine hours after experimental infection and before there are any macroscopic changes in the tissues of the mouth. The virus was present in the saliva for as long as six days p.i. and in bits of epithelium which were being shed from the vesicles of the mouth for as long as eleven days.

"The American Commission and, earlier, Lebailly, also made similar observations.

"The possibility of the existence of carriers is of importance in relation to transmission. The American Commission examined twenty living cattle, specially selected by the Swiss authorities, but were unable to detect a carrier. They also examined post-mortem the feet of twenty-two cattle and one pig at various times after infection, for the presence of virus in closed or healed lesions in or about the hoof. In only one instance—a cow thirty-four days p.i.—was virus found. Lebailly has recorded observations suggesting that cattle are rarely, if at all, carriers, but one hesitates finally to draw the conclusion from negative results that carriers do not exist or are of little importance in the transmission of the disease."—Maitland.

The observations of Minett and Maitland who have performed invaluable original research in connection with this disease, are quoted at length because they show how scientific facts may have a practical application.

In the light of this information laymen will appreciate the difficulties against which the Veterinary Department has to contend in its efforts to arrest the spread of this highly infectious disease.

East Coast Fever.—From time to time demands are made for further research into East Coast Fever in this Colony. It has to be admitted that there are many problems presented by this disease which require elucidation. As for example, it should be ascertained whether there is a latent

form of the parasite in cattle or other animals; whether a salted ox may become a "carrier" of infection and, if so, in what circumstances it becomes infective; whether an animal which has recovered from the disease becomes immune against subsequent infection; whether the life cycle of the brown tick and the parasite in it is what it is supposed to be, and so on.

But although Southern Rhodesia has been handicapped by this disease for more than a quarter of a century it is not a suitable place for carrying out these investigations. In the first place outbreaks are rare, and the methods of dealing with them so drastic and successful that they are generally limited to a few preliminary deaths, after which infected animals and ticks are quickly eliminated. The much maligned "salted ox" is rarely met with, and to seek for the parasite in the wild animals would be comparable to "looking for a needle in a bundle of hay."

In view of the fact that it is the desire of the Veterinary Department to eliminate the disease it would be extremely unwise to set up an active focus of infection for experimental purposes either in a clean or an infected area. Practical experience in other countries has proved the danger of disseminating infection from such areas. True, they might be fenced, but fencing would not entirely eliminate all the risks. Nor, in the circumstances, is it necessary that such investigations should be carried out in Southern Rhodesia, for they are already being conducted elsewhere where more favourable conditions for them obtain. For example, in Kenya Colony where the disease is ever present in enzootic and epizootic form, where all the older cattle in certain areas are "salted," where wild animals abound and where clean and infected ticks can be obtained by the bushel. At Kabete is a well-equipped laboratory with a large and efficient staff, where such research is already being carried out. Also at Onderstepoort, with its unique facilities for scientific study, investigations have been carried out since the earliest days of East Coast Fever and are still in progress. This and similar diseases are being studied in many laboratories.

The whole question as to the desirability of carrying out such research on a large scale in this Colony was discussed with Sir Arnold Theiler in 1927 and it was decided that it was

undesirable. In a memorandum on "The Need for Further Inquiries into East Coast Fever and Allied Diseases of Cattle," published by the Empire Marketing Board, this authority, in dealing with the possibility of cattle recovered from East Coast Fever acting as reservoirs of infection, writes: "This problem can only be solved with experiments carried out under natural conditions, viz., exposing immune cattle in sufficiently large numbers over several years. . . . The point of importance is that a *great number* of immune cattle be obtained; the larger the number, the more certain the results. The number of susceptible cattle could be reduced, but the number of immune cattle should be increased: finally there ought to be about an equal number of both. The Director of Veterinary Research for Southern Rhodesia sees objections to this experiment being carried out in Rhodesia, and certainly his objections are valid, since in order to obtain immune cattle, the infection must be maintained somewhere and may be the cause of a further spread of the disease."

In the circumstances the apparent neglect on the part of the Veterinary Research Department of this Colony to carry out such investigations into this disease, appears to be justified.

Tobacco Growing in Southern Rhodesia.

SEED-BEDS.

By D. D. Brown, Chief Tobacco and Cotton Expert.

In view of the approaching season for the preparation and sowing of tobacco seed-beds, it is thought to be advisable to reprint the following article which appeared in the Rhodesia Agricultural Journal *of September,* 1926. *Certain portions of the article have been revised and brought up to date, and what is now published will, we feel sure, be of the greatest use to growers of tobacco, particularly to those who have not grown a crop in recent years.*

We would take this opportunity of reminding prospective growers of the importance of producing leaf of good quality and of the type desired by the manufacturers. Also, that an essential condition to successful tobacco growing is the raising of strong, healthy plants.—Ed.

The seed-beds are the foundation of the tobacco crop, and should the grower fail to raise good, strong, healthy seedlings, unsatisfactory results will be the consequence. The work in connection with the preparation, seeding and after care of the seed-beds is very often not given proper consideration, and, when this is so, optimum results can hardly be expected. Although the handling of seed-beds is not an intricate business, it would be well to bear in mind that, in order to produce suitable seedlings, unremitting care and attention are called for on the part of the tobacco grower.

The open frame type of seed-bed is used in this Colony, and has proved suitable under existing climatic conditions. The type is a simple one, furnished with low sides and a covering of cheese-cloth or grass.

Selection of Site.—Careful consideration should be given to the selection of a suitable site for the seed-beds. The area selected should, if possible, be well sheltered from the prevailing winds, for seed-beds placed in an exposed position not only require more watering, but the young plants do not thrive as they should. It is important that the beds should be near a permanent water supply.

In order to ensure the maximum supervision, the site chosen for tobacco seed-beds should be as near the homestead as possible. The proximity to the homestead will necessarily be governed by such considerations as suitability of soil, water supply and shelter. If possible, the beds should also be reasonably close to the fields. The beds should be located so that the plants may have the maximum amount of sunlight, the early morning sunlight being especially beneficial. To attain this, the beds should have an eastern or north-eastern exposure whenever such is possible. It may be necessary to erect an artificial windbreak.

A simply-constructed shelter is made by placing posts at each corner of the seed-bed area and stretching two strands of wire round to each post. The lower strand of wire should be about one foot from the ground level and the upper strand of wire a little below the level of the top of the windbreak. The wires should be supported by other posts placed at intervals between the corner posts. Long grass, reeds or maize stalks are next placed in an upright position against the wires and firmly laced to the upper and lower wires. A gateway should be left in one side of the fence, preferably on that side away from the prevailing winds.

The area selected should not be on a steep slope. When it is not possible to have a fairly level site, the beds may be arranged in terraces on a slightly sloping area. In the latter instance it will be necessary to dig a drain above the site in order to prevent any rush of water flowing down the slope and over the beds during the rains. Good drainage should

be provided for wherever the grower fears any possibility of damage due to a rush of water during rain storms.

Large trees have a detrimental effect on the growth of the seedlings through their roots spreading under the beds and depriving the tobacco plants of food and water. For these reasons, therefore, no large trees should be too close to seed-beds.

Soil.—The most suitable soils for seed-beds are sandy loams and alluvial soils which have a good supply of humus and are naturally well drained, friable and fertile. It may not always be possible to find an ideal type of soil on the area selected for a seed-bed site, and when this is the case much can be done to change the texture of the soil to render it more suitable. In cases where the soil is too light and friable, a few wagon-loads of heavier soil should be applied over the surface of the site. Where the soil is too heavy and stiff, a similar application of sand will improve the texture and render such soils more suitable for raising tobacco seedlings. The soil used for tobacco seed-beds must be well drained. If the soil becomes saturated with water, the plants do not make satisfactory growth, and are more liable to become affected by disease.

The beds for the early sowing may be situated on the edge of a vlei, provided the soil is not too cold, but such locations should be avoided for later plantings, as during the rains the vlei soils become water-logged. On many farms the soil near the only available water supply is inclined to be too wet. In such instances it will be necessary to provide adequate drainage, and expense of both time and money should not be spared to carry out such operations as are necessary thoroughly to drain the site.

The season's supply of plants may depend on the proper construction of the drains. The drainage of land with a sufficient fall, away from the seed-bed area, presents no serious difficulty. Where it is not possible to have land with the required fall, the work of constructing drains will be greater, and the outlets will need to be carried to a greater distance from the beds. Generally speaking, it is necessary to cut a trench round the four sides of the site and have an outlet cut from the lowest point to allow the water from the

trenches to run off. Small drains are of no practical use; a satisfactory drain is one about four feet wide and of sufficient depth thoroughly to drain the site of the beds. Where artificial shelters are to be erected round the beds, space should be left for them between the trenches and the seed-bed area. Negligence in the matter of drainage may be the cause of failure in the production of seedlings, and, as previously stated, the supply of good, healthy seedlings is essential for the production of the tobacco crop. The question of drainage applies particularly to the seed-beds for Turkish tobacco, as these beds are sown later in the season, when the heavy rains are on.

Tobacco seed-beds should not be made continuously on the same soil. When the same site is used annually, the seedlings are more liable to the attacks of insects and fungus and bacterial diseases. The soil is also rendered less suitable through the constant applications of water and the annual sterilising. New land is preferable, as weeds are less troublesome, and the plants are not so subject to the attacks of insect pests and fungus and bacterial diseases.

Some growers prefer to renew the soil annually in permanent seed-beds; provided the site is sterilised each year, there is no objection to this practice.

Preparation of Seed-Beds.—First of all, the site should be cleared of all undergrowth and rubbish, after which it should be levelled. The area cleared should be in excess of the actual area required for beds, so that a cleared space will be left round the seed-beds. This work is best carried out during the winter months and some time previous to the final preparation of the beds. An application of well-rotted pulverised kraal manure should then be broadcast over the surface of the site. The dressing should be a fairly heavy one, for tobacco seed is very small and can store up only very small amounts of plant food. The plants are therefore soon forced to draw their food supply from the soil, consequently tobacco seed-beds should be in a high state of fertility. The soil should have an abundance of available plant food at the time the seed germinates, and a sufficient supply to maintain a steady growth of the seedlings during the period of time they remain in the beds.

The dressing of kraal manure is applied some time before the final preparation of the seed-beds, in order that it may become thoroughly decomposed and converted into humus before the seed-beds are sown. When the kraal manure has been applied, it is incorporated with the soil by ploughing or spading. After this the soil should be worked at frequent intervals to destroy most of the weeds before the final preparation of the beds; the sterilising will complete the destruction of weeds. In the final preparation, a short while before the date of seeding, the site is lined off into beds with pathways between.

The dimensions of the beds can be arranged to suit the site and the convenience of the grower. The beds may be of any desired length, the width, however, must be restricted in order that the middle of the beds may be easily reached from the pathway on either side. When the beds are too wide, difficulty is experienced in the weeding and also in removing transplants without damage to those remaining in the seed-bed.

The beds can be made from three feet to five feet wide; the most convenient width has generally been found to be four feet. Very narrow pathways between the beds are the cause of much inconvenience and loss of time. Whenever possible, the pathways should not be made narrower than three feet; this width of path leaves sufficient room between the beds for the watering, weeding and removal of plants.

After the beds are measured and marked off, the top soil in the pathway strips should be thrown up on to the adjoining seed-bed; this operation when completed leaves the beds raised above the level of the pathways. Each seed-bed should then be brought into a fine tilth and properly levelled prior to being sterilised.

There are several methods of sterilising the soil. Under Rhodesian conditions the open-fire method gives satisfactory results. By this method the weed and grass seeds are destroyed and insects hibernating in the soil are killed. The brushwood, maize cobs or other material should be placed evenly over the surface of the seed-beds. The burning is best done when there is no wind blowing, so that full benefit may be derived from the heat generated by the burning material.

Tobacco stalks should not be used for sterilising seed-beds, as they may have small portions of diseased leaf adhering to them, and should any of these be left lying around the seed-bed site a fresh infection of disease, particularly wildfire and angular leaf spot, may result. Also, when tobacco stalks alone are burned, an excess of potash is formed which is detrimental to the germination of the seed. A layer of dry grass should be placed on the beds, and on top of the grass a layer, six inches in depth, of maize cobs should follow. A layer of brushwood about two feet deep can be used in place of the maize cobs.

When the soil is properly sterilised, it will be of a light brick-red colour, and will be very friable and easily pulverised. To remove any doubts as to the depth the soil has been sterilised by the fire, a simple test may be made by burying a potato about three inches below the surface of the soil in the seed-bed before burning, and when the potato has been cooked until the skin peels off easily, the soil has been sterilised. The soil should not be sterilised when saturated with water, and, on the other hand, the soil should not be too dry. Best results are obtained when the soil contains just sufficient moisture for cultural operations. After burning, the beds should be allowed to cool before being enclosed with boards, brick, sheets of iron or by hessian suspended from a wire.

In Rhodesia the usual method is to place two courses of brick round the outer edge of the bed, the bricks being placed one on another, flat side down. A single row of bricks can also be used if placed on edge. This will require fewer bricks, but the sides will be more easily displaced. Boards and iron are not generally used, owing to expense and lack of material. Some growers have stretched a plain galvanised wire round the beds, about six inches above the level of the bed surface, and to this have sewn a strip of hessian, the lower edge being buried in the ground. The use of hessian cannot be recommended where white ants are likely to be troublesome.

After the beds are suitably enclosed, all the unburned portions of the material used for sterilising the beds should be removed. The ash is left on the beds, and is an excellent fertiliser, as it contains carbonate of potash, the best form in which potash salts can be applied to tobacco.

A dressing of fertiliser may now be applied. An excellent fertiliser is as follows:—

½ lb. nitrate of soda
½ lb. sulphate of potash } Mix thoroughly.
1 lb. superphosphate

The above quantities when mixed together are sufficient for 10 square yards of seed-bed.

After the fertiliser has been applied, the beds should be dug over to a depth of roughly three inches. The unsterilised soil should not be brought up to the surface, as this would tend to minimise the advantage gained through the sterilising process. Great care should be taken thoroughly to mix the ash and fertiliser with the surface soil.

The seed-beds should now be brought into a very fine tilth by means of a hand rake, the same implement being used thoroughly to level the bed from end to end and also from side to side. When beds are not level, there is a danger of the tobacco seed being washed down to the lower portions of the surface of the seed-bed, thus causing an undesirable unevenness in the stand of the seedlings.

To support the seed-bed covering, a wire should be placed down the centre of the bed. Pegs are driven in at intervals to within twelve inches of the surface, and the wire is placed on top of them. This completes the preparation necessary before the beds are seeded.

The Time for Sowing.—Seed sown early in the season will produce seedlings ready for transplanting usually in about 60 days; later sowings generally produce seedlings in less time.

The usual time for sowing flue-cured Virginia tobacco seed-beds is from the middle of September to the end of October. This enables the grower to produce seedlings ready for transplanting during the months of November and December.

The flue-cured Virginia crop should not be planted out after the end of December, as late-planted tobacco seldom produces leaf of good quality, and curing is difficult.

The seed-beds for the dark fire-cured type are sown from the first week in October onwards. The transplanting season commences at the end of November.

Seed-beds of Turkish tobacco are sown from the beginning of December to the middle of January, the crop being transplanted from the latter half of January to the end of February.

(To be concluded.)

DATES OF AGRICULTURAL SHOWS.

Umtali Agricultural Society, Umtali, 24th and 25th July.

Bindura Agricultural Society, Bindura, 25th July.

Rusape Agricultural Society, Rusape, 7th August.

Rhodesia Agricultural Society, Salisbury, 26th and 27th August.

Midlands Agricultural Society, Gwelo, 28th August.

Bulawayo Agricultural Society, Bulawayo, 2nd and 3rd September.

The Rhodesia Railways have agreed to grant the same concession on the road motor service as that allowed when show exhibits are sent by rail, *i.e.*, full rates will be charged on the forward journey, and, if unsold, the exhibits will be returned to the senders free of charge, provided the necessary certificate is obtained from the secretary of the show.

The Potato

(Solanum tuberosum.)

METHODS OF CULTIVATION IN SOUTHERN RHODESIA.

By S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

Description.—The common potato is known botanically as *Solanum tuberosum*, and is a member of the natural order of plants named *Solanaceæ*. In this same group of plants are included a number of others of considerable economic importance such as tobacco, capsicum, bella donna and tomato.

Many of the members of this family contain alkaloids, as does the potato itself under certain conditions, for instance when the tubers are exposed to the light for some time, they become green in colour, and develop a bitter taste due to the formation of a poisonous alkaloid.

The genus *Solanum*, from which the natural order derives its name, comprises about 900 species of plants of which six bear tubers, the chief of these being the common potato.

The potato is an herbaceous annual, though it functions as a perennial by virtue of its tubers, by means of which its continued reproduction is assured. The flowers are borne in cymes, and have a five-lobed corolla, which is white, mauve or lavender in colour.

The main root system is fibrous and much-branched, and chiefly distributed through the upper layers of the soil. Adventitious roots are also developed by the underground stems, at the apices of which latter the tubers are produced. In the "early" varieties the underground stems are short, being not more than two to three inches long as a rule. In the

main crop varieties, giving heavier yields and having a longer growing season, these rhizomes are longer and more branched, but excessive length of the rhizomes is usually associated with inferior yielding capacity.

The tubers may roughly be divided according to their shape into three main types, which are sufficiently distinct and constant to form a means of classifying the various cultivated varieties, viz., (1) round, (2) oval, (3) "kidney." The round type is more or less spherical and has fewer "eyes" than (2) and (3). The oval and "kidney" types are both elongated, but the oval are thickest in the middle and taper to both ends, whilst the "kidney" type are thickest at the "rose" end and taper towards the "heel." The tubers are thickened portions of the underground stems or rhizomes and in them is stored a large reserve food supply for the young plant, in the form of starch. At the "heel" end they usually show a piece of the withered rhizome.

The "eyes" of a tuber may consist of as many as twenty, but usually not more than three buds, and are arranged spirally round the tuber. At the "rose" end these "eyes" are more crowded together than at the "heel." They are really undeveloped lateral branches, and when germination takes place some develop and grow out into the aerial stems or "haulms" of the plant. The central eye at the "rose" end usually produces the strongest shoot, and if this shoot is broken during planting, those which arise from neighbouring eyes are never so strong and vigorous. The "eyes" at the "heel" seldom develop, but normally remain dormant.

The bulk of the tuber consists of starch, which is the reserve food material from which the young growing plant draws its nourishment until it can obtain its food direct from the soil. When germination takes place an enzyme-diastase acts on the starch converting it into sugar, which is transferred to the growing shoots and adventitious roots. When the food supply in the old tuber is exhausted the latter continues to perform a useful function during dry periods by supplying the plant with moisture which it has absorbed from the surrounding soil.

It is important to remember that the underground stems or rhizomes will only produce tubers in darkness and this

is one of the reasons why "earthing up" of the crop is so necessary.

It has been repeatedly demonstrated that the use of properly sprouted "seed" tubers gives increased yields of tubers, and one reason is this. Seed tubers which are sprouted in the light produce short thick shoots having many leaf buds, and it is in the axils of these leaves that the tuber-bearing rhizomes arise. Tubers sprouted in the dark, or underground, produce shoots having fewer leaf buds and so there are fewer points from which the rhizomes may develop.

Origin.—All authorities are agreed that the potato came originally from the high lands of Peru and Chile, where it is still found growing in the wild state, but it was first discovered by the Spaniards in Ecuador at the beginning of the 16th century, the native inhabitants at that time largely living on maize and potatoes. The Spaniards first introduced the potato to Europe probably about the year 1535, and Sir Walter Raleigh introduced it from North America to Ireland in 1585 or 1586. Its spread through Europe was rapid and it is now a universal food crop of the white races throughout the world.

Uses and Composition.—The potato varies very considerably in composition according to the variety, the soil and climate in which it is grown, and the degree of maturity and conditions under which it is stored.

The following analysis* is the average of 465 analyses and gives the average percentage composition of the potato tuber.

Water.	Starch.	Protein.	Ash.	Fat.	Fibre.
78.8	17.4	2.2	1.1	0.1	0.4

A large proportion of the protein and ash constituents or minerals is contained in the outer layers of the tuber and much of this is lost in peeling for cooking. Therefore the potato loses least of its food value if boiled or baked in its skin.

The ash contains a high percentage of potash and phosphoric oxide, the former constituting 60.4 per cent. and the latter 17.3 per cent., according to an average of 53 analyses

* "Feeds and Feeding," by Henry and Morrison.

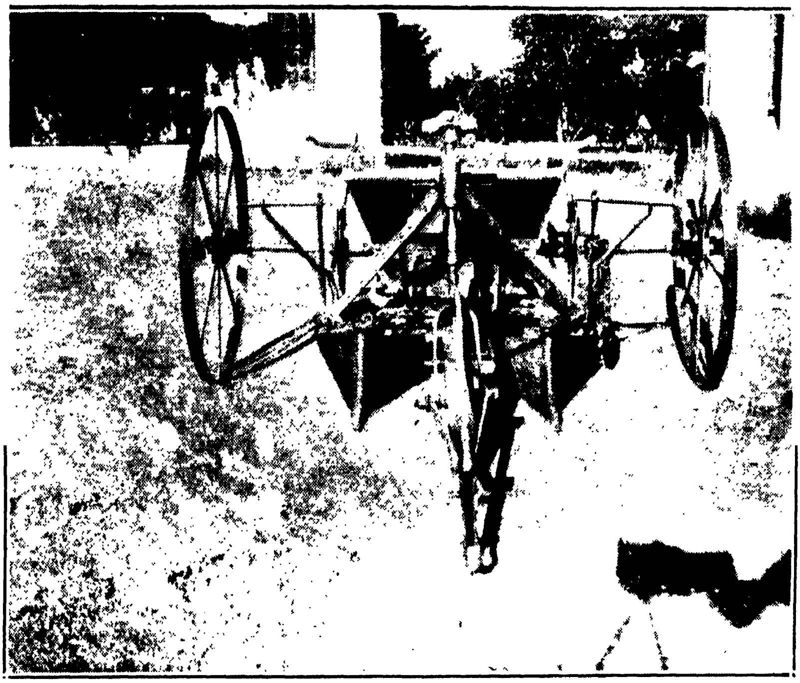

Fig. 1.

The type of potato ridging plough and fertiliser distributor combined which is much used in Scotland. It has given excellent results on Glenara Farm, near Salisbury.

by Wolff quoted by Blyth in his "Foods." This gives some indication of the great need the potato plant has for an ample supply of available potash and phosphate in the soil.

Besides its value as human food the potato has a number of other uses. From it large quantities of starch are still manufactured, which is mainly employed in making sizing for paper and textiles and for other technical processes. In Germany in particular, and in other parts of continental Europe, a large industry has grown up round the production of alcohol from potatoes. In 1906 the production of absolute alcohol from potatoes in Germany exceeded 115,444,445 gallons. This alcohol is used largely in the manufacture of varnish, explosives and chemicals, and also for lighting, heating, and power in internal combustion engines. The "mash" resulting after the distillation of alcohol is a valuable cattle food.

The potato is also a useful stock feed and the "culls," which are of no value for sale or seed, may well be fed to cattle, horses or pigs. According to Henry and Morrison ("Feeds and Feeding") up to 30 lbs. per day of cooked potatoes may be fed to milk cows and somewhat less if fed raw. As much as 17 lbs. per day may be fed raw or cooked to horses and small quantities may be fed each day to pigs, but in this case the tubers should be cooked and fed mixed with grain. In France, Girarde fed 55 to 66 lbs. of cooked potatoes per day to fattening steers and 4½ to 6½ lbs. to fattening sheep.

Since potatoes are deficient in protein and ash, they are not a suitable feed for young, growing stock. Animals should not be watered soon after feeding on potatoes, but preferably half an hour before feeding.

Potatoes are also useful to the poultry keeper and can be fed in large quantities to fattening birds, ducks, geese and turkeys. For this purpose they should be cooked and fed in the mash. They are unsuitable for laying hens or for young growing birds.

Flour, glucose for jam-making, syrup and mucilage, besides a number of tinctures, are also made from the potato.

Soil and Climate.—The ideal type of soil for potato culture is a deep, free-working, fertile loam, which is well

drained and above all, possesses an ample supply of decayed organic matter or humus.

A free-working, friable soil is essential for the best results for the following reasons. The root system of the plant is weak and fibrous, having no strong tap-root or side roots which can penetrate a stiff, heavy soil. Since the growing season of the crop in this Colony is so much shortened by the attack of Early Blight disease, as compared with the long growing season assured in England, it is essential that the potato crop should be able to obtain its food supply quickly and easily. This is in part assured by providing it with a light open soil and by affording ample and quickly available supplies of plant food.

An open porous soil is also necessary to enable the tubers to develop freely. In heavy soils, especially when periods of drought during the time the tubers are growing are experienced, the latter make very irregular growth and their skin becomes roughened.

In heavy soils, or in those which harden on drying out in autumn, the crop is difficult to lift, the tubers may be damaged during the operation and many may be left in the ground. Stiff, heavy soils are also very difficult to work and often retard planting operations. In a light open soil provided with an ample supply of organic matter, fertilisers and manures applied to the crop are more readily available and will be more effective. Nevertheless, the potato crop can be grown with success on practically all types of soil which are fertile, have a sufficient supply of humus and are well drained. Even the comparatively heavy loams of the maize belt will grow heavy crops of good quality, provided that a sufficient supply of organic matter is made available by heavy dressings of kraal or farmyard manure and by green manuring. Potatoes grow particularly well on virgin soil provided it has a sufficient supply of humus and has been very thoroughly worked to a fine tilth. It is a good practice to green manure virgin soil before planting potatoes, as this mellows the soil and increases the supply of humus and available plant food.

Where potatoes are grown on land which is under irrigation, year after year great difficulty is usually experienced

on the red and chocolate soils of this Colony in obtaining a satisfactory tilth, owing, no doubt, to the exhaustion of the humus supply. There is often very little time in which to prepare the land after the cessation of the rains owing to the necessity of early planting to ensure catching the better prices obtained in the early market. This condition of affairs may readily be remedied by growing a green manure crop such as sunn hemp, on the land during the summer and ploughing it under in February or March. By thus maintaining the humus supply in the soil, it will be a simple matter to obtain a mellow tilth. It will also help to maintain the natural fertility of the soil and make it possible to reduce somewhat the quantity of fertilisers which must be applied, and at the same time will assist the crop to make full use of those which are applied.

Varieties.—Practically only one variety of potatoes is grown in Southern Rhodesia at the present day, namely, the Up-to-date. Each year considerable quantities of Scotch Up-to-date "seed" are imported and the first and second crops from this are mainly used for the further planting.

Many other varieties have been tried in the past and have been discarded for various reasons, although some, such as Majestic, have proved to be high yielders. Some have failed to hold their place owing to inferior keeping qualities and others owing to low grade.

The results of trials of a number of varieties which have been carried out on the Agricultural Experiment Station, Salisbury, are given in the table below.

Variety Trials: Yield per Acre in Bags of 150 *lbs.*

Variety	1925-26	1924-25	1923-24	1922-23	1921-22	*Average yield	Number of seasons under trial
Up-to-date	80	123	50	...	...	84	3
King's Perfection ...	95	111	...	...	...	103	2
Majestic	89	117	38	100	53	79	5
White City	74	79	45	74	...	68	4
Kerr's Pink	58	76	34	120	36	65	5
Tinwald Perfection ...	61	65	38	107	43	*63	5
King George	47	101	25	75	40	58	5
Great Scot	35	89	34	59	63	56	5
Arran Comrade ...	38	54	33	45	46	43	5
King Edward	35	58	30	...	...	41	3
Lord Roberts Up-to-date	92	...	...	...	...	...	1

The following comments on these trials by the manager in charge of the Experiment Station are extracted from his report for the year 1925-26.

"These experiments commenced in 1921-22, and have been continued each year. The crop is grown in the summer only, so the seed has to be kept over from season to season. Improved methods of keeping the seed resulted in better stands among the mid-season varieties than had been obtained for some years, but in two or three instances very low yields of these have to be reported, which indicates that these varieties tend to degenerate after having been grown but a few years in this country. It is found that, as a general rule, the kinds which mature quickly and are usually known as "early" or "mid-season" varieties degenerate sooner than the main crop and late sorts. Arran Rose, Dargill Early, Epicure, Early Rose and Bloomfield were excluded from our trials last year, after repeatedly yielding indifferently over a period of three or four years. This season's trials show that Arran Comrade, King George, Great Scot, Tinwald Per-

fection and Lochar cannot be included in our best six varieties, so they will be discarded.

"The Up-to-date variety has consistently proved itself a good yielder, and so far is rivalled only by Majestic and King's Perfection."

It is probable that the almost exclusive preference growers show for the Up-to-date variety in this Colony is due to the two following reasons: Firstly, its yield and keeping qualities are good, and, secondly, it has proved to be remarkably resistant to the virus diseases of the potato such as "mosaic," leaf streak, etc., which cause such havoc with the stand of plants in the field in the case of many of those varieties, which have been discarded. It has also proved more resistant to the attacks of "Early Blight" (*Alternaria solani*), which causes so much loss in Southern Rhodesia by shortening the growing season of the crop by three to five weeks.

It is advisable that any new main crop varieties which growers may propose to import for trial should possess strong resistance to virus diseases, as conditions of temperature and moisture during the summer season are particularly favourable for the development and spread of these diseases as compared with the normal conditions obtaining in Great Britain. Virus diseases must be held accountable for much of the deterioration in yielding power of our potatoes after the third year following introduction, particularly where, as is normally the case, no methods of selection for freedom from disease, and high yielding power are practised.

Manures and Fertilisers.—It is essential for the profitable production of the main or summer potato crop that the soil shall be in high condition both as regards fertility and tilth, since the growing season of the crop is only 4 to 4½ months long as compared with a growing season of 7 months in Great Britain. This short season is largely due to the attacks of "Early Blight" (*Alternaria solani*), which kills off the haulms of the plants some time before the crop has reached normal maturity and just at the stage of growth when the tubers are swelling and most in need of the supply of food material manufactured by the foliage. These facts must always be borne in mind when considering the question of the

manuring of the crop, since it makes it particularly necessary to force its growth as far as possible, giving due care to the danger of inducing an excessive top growth at the expense of tuber production.

With the early winter crop there is the same need for forcing the growth and hastening maturity, since the best prices are obtained for the new potatoes which are first on the market after the main crop supply is more or less exhausted.

Need of Organic Matter.—An ample supply of organic matter in the soil is the first essential to success in growing potatoes, since this assures a fine open tilth to the soil, and without it the crop cannot make proper use of the fertilisers which are applied to force its growth and supply the large needs of the plants for readily available food. This is best assured by the application of farmyard manure. If high yields of potatoes per acre are aimed at, and this normally helps to assure a low cost of production, it is almost essential to apply heavy dressings of farm manure and a dressing of 15 to 18 tons per acre is not excessive. The biggest and most successful growers of summer potatoes in this Colony are now giving as much as 20 to 22 tons of farm manure per acre.

Where such heavy dressings are applied, they may be spread and covered by the first ploughing. With light dressings it will probably be best to spread the manure in the furrows before planting.

The manure must be in a thoroughly rotted condition so as to ensure availability of plant food and to avoid, as far as possible, subsequent trouble with excessive weed growth.

One of the most important functions of such heavy dressings of manure is to render the soil as friable as possible, so that a very fine open tilth may be maintained which will facilitate the working of the soil; render easy the penetration of the soil by the weak root system of the plant; and ensure that no check is placed on the development of the young growing tubers. The easy lifting of the crop with a minimum of loss is also assured, as also the moist cool condition of the soil required by the potato plant for its best and most rapid development.

Green-manuring for Potatoes.—On most farms in Southern Rhodesia the amount of farmyard or kraal manure available is quite inadequate and recourse must be had to green manuring, preferably with a legume, to supply the requisite organic matter. For this purpose any of the leguminous green manures normally grown in this Colony may be employed, but sunn hemp is particularly recommended as it is an admirable weed-smotherer if sown (broadcast) at the rate of at least 40 lbs. per acre and, furthermore, it is particularly efficacious in improving the tilth of the soil and in breaking up the subsoil, owing largely to the numerous strong top-roots of such a thickly sown crop. These roots penetrate the subsoil and on dying leave there much organic matter, thus improving the drainage of the subsoil and extending the feeding range of the crop's root system.

As already stated green manuring to replace or supplement the use of farm manure is particularly useful where the potato crop is grown under irrigation in winter.

A word of warning concerning the practice of green manuring preceding the potato crop is necessary. The green manure crop should be ploughed under sufficiently early in the summer to allow time for its proper rotting down before the potato crop is planted and care must be taken to stir the soil adequately by late ploughing and harrowing, so as to distribute thoroughly the organic matter throughout the land. The following condensed results of an experiment carried out on the Agricultural Experiment Station, Salisbury, support this view.

Treatment.	Potatoes planted in October.	Potatoes planted in December.
Legume green-manure ploughed under in previous autumn	81.5 bags	101.5 bags
Oats reaped in previous autumn	74.6 bags	90.0 bags
Differences in yield per acre due to green-manuring ...	6.9 bags	11.5 bags

N.B.—All the plots received a basic dressing of 6 tons of farm manure and 200 lbs. of bone and superphosphate per acre.

Yields per acre are given in bags of 150 lbs. weight of tubers. The experiment has been in progress for 4 years.

As will be seen from the above figures on those plots where the green manure crop was allowed a further two months for rotting down before planting of the potatoes, the difference in yield per acre in favour of green manuring is considerably greater. It is perhaps well to point out here that the difference in favour of green manuring as compared with the reaping of an oat crop would probably have been much greater had the land not also received a dressing of six tons of farm manure per acre. Whatever method of maintaining the humus content of the soil is employed, artificial fertilisers are necessary to supplement the farm manure or green manuring.

Potash.—Since the potato plant manufactures and stores large quantities of starch, it is natural that it should respond to potassic fertilisers, for potash is intimately concerned with the translocation of starch in the plant.

Sulphate of potash is the form in which potash is usually supplied to the crop since it is the general opinion of potato growers throughout the Empire that potash in sulphate form gives tubers a better quality as regards colour and palatability than chloride of potash, though there is little direct scientific evidence in existence in support of this view. The question deserves investigation, for potash in chloride form is appreciably cheaper.

Wood ash may be used as a source of potash and applications of 1,000 to 2,000 lbs. per acre can be recommended, but it is advisable to obtain an analysis of a composite sample of the ash in order to regulate the weight of the dressing accordingly. The potash content of wood ash in Southern Rhodesia has been found to vary between 5.22 per cent. and 0.41 per cent.; it contains about the same proportions of phosphoric oxide and from 18 to 50 per cent. of lime.

In countries where the "common scab" (*Actinomyces scabies*) is prevalent, the free use of wood ash for potatoes is inadvisable, since a high lime content in the soil tends to produce an alkaline reaction which favours development of the disease. In Southern Rhodesia this objection does not, at present, hold good as the presence here of "scab" has not yet been reported.

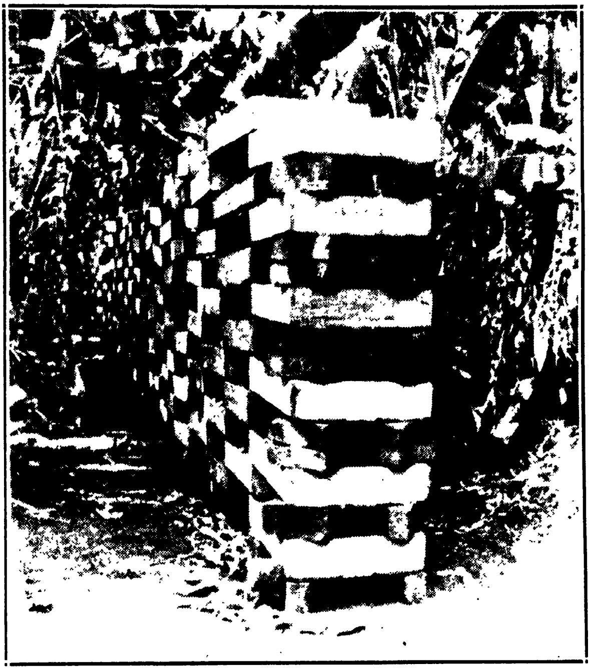

Fig. 2.
"Seed" potatoes stored in open wooden crates during winter under thick shade of plaintains. Glenara Farm, near Salisbury.

Fig. 3.
Three hundred yards of "seed" potatoes under the shade of cypress trees at Glenara Farm, near Salisbury. The potatoes are in a single layer on the bare earth.

Fig. 4.

Crop from "seed" of strain selected for eight years for high yield, large size of tubers and freedom from diseases. Yield per acre, 138 bags. Agricultural Experiment Station, Salisbury "Selection Trials for Maintenance of Yield."

Fig. 5.

Crop from "seed" of strain which has not been selected for high yield. It has degenerated in size of tubers and yield per acre, due to hereditary tendencies and virus diseases. Yield per acre, 45.6 bags. This strain and that shown in Fig. 4 have been grown from the same original stock imported in 1923. Agricultural Experiment Station, Salisbury—"Selection Trials for Maintenance of Yield."

The ash obtained by the burning of sunflower stalks and the heads after the removal of the grain also contain potash in large quantities (approximately 33 per cent., as shown by analyses carried out by the chemical section of this Department) and may be applied at the rate of about 300 to 400 lbs. per acre. This ash also contains about 17 per cent. of lime.

The heavier soils in this Colony, if not exhausted by continuous cropping, contain large quantities of potash, but the lighter sandy soils may be expected to be somewhat deficient in this food, and dressings of sulphate of potash, wood ash or sunflower ash will require adjustment accordingly. Eighty to one hundred lbs. of sulphate of potash per acre will normally be found to be sufficient for the needs of a crop yielding eighty to one hundred and twenty bags of tubers per acre, but the individual farmer should carry out trials of different rates of application on his own soil to determine which rate is most profitable. The same advice is offered with regard to the rate of application of nitrogen since both these are expensive plant food elements.

Nitrogen.—Moderate applications of a readily available form of nitrogen are required to assist the quick development of the "haulms," and the most suitable form for this purpose is ammonium sulphate. Applications of 50 to 100 lbs. per acre at the time of planting are suitable. If no farm manure is available, or if the land has not been green-manured it may be advisable to supplement the dressing of ammonium sulphate with some organic form of nitrogen, such as blood meal, which, since it is more slowly available, will help to assure a continuous supply of nitrogen throughout the growing period. This is a question, however, which requires further investigation since some evidence exists that organic forms of nitrogen may be too slowly available under local conditions to be of use to a short-season crop such as potatoes. As an alternative measure the dressing of sulphate of ammonia at planting time may be somewhat increased.

Although it is undoubtedly profitable to apply moderate dressings of sulphate of ammonia, yet care must be taken not to apply too much, since an excessive amount of nitrogen causes the tubers to be waxy and unpalatable; the crop will

be more liable to suffer from disease; maturity is retarded, and the plants will produce excessive top-growth at the expense of tuber production.

When the land has been green-manured with a legume previous to planting potatoes, the supply of nitrogenous fertiliser should normally be reduced.

If for any reason it has not been possible to apply sulphate of ammonia at planting time, nitrate of soda can be used as a top dressing after the first leaves are well above ground. But this form of nitrogen should never be applied at planting time since it is too quickly washed through the soil and so lost, unless a growing crop is ready to make immediate use of it.

Nitrogen is more expensive to buy than the other plant food elements and as far as possible it should be grown on the farm in the form of a leguminous green-manure crop.

Phosphate.—The principal fertiliser required by the potato crop, however, is phosphate, and the form which has been found best is superphosphate, chiefly because it is the most readily available. As already stated the short growing season of the crop makes it necessary to supply the food requirements in as readily available a form as possible. Applications of 300 to 500 lbs. or even more per acre of superphosphate may be used, in addition to 10 to 15 tons of farm manure, 80 to 120 lbs. of sulphate of potash, and 50 to 100 lbs. of sulphate of ammonia.

The cheapest form in which phosphates can be supplied to the soil is in the form of raw rock phosphate, but this fertiliser is too slowly available for direct application to potatoes. However, it can be applied before planting a green-manure crop preceding potatoes, and in this way the green-manure itself will be benefited and so will supply greater quantities of organic matter and nitrogen to the land. The longer period of action on the rock phosphate of the various weathering agencies in the soil and the action of the organic acids formed during the rotting down of the green manure all help to bring the plant food into a form which is more readily available to the crop. Against this practice is the fact that the farmer's capital invested in fertiliser is tied up for a longer period without giving a return. This objection,

of course, is not of such importance where the green-manure is grown in the summer preceding a winter crop of potatoes, and some of the most successful growers employ this system, applying 400 to 500 lbs. per acre of raw rock phosphate broadcast before sowing sunn hemp. This is undoubtedly good practice, but in the absence of direct experimental evidence the writer would advise that a proportion at least of the phosphate should always be supplied in the form of superphosphate in the furrow at the time of planting, so as to stimulate quick strong growth in the young plants.

A number of complete fertiliser mixtures for potatoes are marketed locally and have given good results when applied at a rate of 300 to 600 lbs. or even more per acre, in addition to a fairly heavy dressing of farm manure, or following a green manure crop ploughed under.

As a general rule, however, it can be said that growing potatoes on a complete artificial fertiliser alone, without the application of farm manure or a previous green-manuring, is not likely to be profitable.

Method of Application of Fertilisers.—It is best to apply the artificial fertilisers in the furrow at the time of planting, so that they will be at the immediate service of the crop as soon as roots are formed. This tends to force the growth of the plants to make the best use of its short growing season. The fertiliser should not be allowed to come into direct contact with the tubers, and to avoid this a little earth should be kicked over the fertiliser before the "seed" tuber is actually placed in the furrow, or a branch of a tree may be drawn up the furrow to mix the fertiliser with the soil.

Liming and Rotation of Crops.—The potato is very tolerant of acid conditions, and it is unlikely that Southern Rhodesian soils will require direct liming for the benefit of this crop alone. However, since potatoes cannot be grown on the same soil, as a rule, indefinitely, the lime requirements of other crops in the rotation must be considered.

In the event of the "powdery scab" disease of potatoes appearing in this Colony in the future, it may become advisable to apply lime before planting potatoes, since acidity of the soil encourages this disease. On the other hand, it must be kept in mind that alkaline soil conditions favour the

development of "common scab" (*Actinomyces scabies*), which, though not recorded in Southern Rhodesia, is present in the Union of South Africa.

The chief value that applications of lime to the other crops in the rotation might have for potatoes in this Colony would be the liberation into solution of potash from the zeolitic double silicates in the clay. Thus the unavailable potash in the clay would become available to the potato crop and it might thus be possible to reduce the direct rate of application of potash. A further indirect action of the liming is the stimulation given to the beneficial bacteria in the soil, which bring about nitrification, and thus render the unavailable nitrogen in the soil available to crops.

For a number of years past a standard dressing for the potato crop of 18 tons of farm manure and 400 lbs. per acre of complete fertiliser (analysis 20 per cent. P_2O_5; 4 per cent. nitrogen; 10 per cent. K_2O) has been used on the Salisbury Agricultural Experiment Station and this treatment has given yields of tubers varying between 80 to 150 bags of 150 lbs. each per acre.

Preparation of the Land.—Like barley, the potato is a delicate feeder and requires a soil in as fine a condition of tilth as is possible so that the plants can readily obtain their food supply from an easily available source. The rather weak root system must be given the opportunity to penetrate the soil without difficulty and the tubers must be able to expand during growth with the least possible resistance from the soil. Great care should therefore be given to the preparation of the land before planting.

The soil should be as deeply ploughed as the conditions of sub-soil allow where it is the main crop that is to be planted in spring. This preliminary ploughing should be carried out in the early autumn, so as to allow for the fullest possible weathering of the land. If the soil turns up at all cloddy the plough should be followed immediately by a roller or disc harrow to break down the large lumps whilst there is still some moisture in the land, though the soil should not be brought to too fine a tilth at this stage. After the first ploughing a grubber or Martin type of cultivator may be used with advantage to loosen and aerate the subsoil without

bringing it to the surface. This will also improve the drainage.

A few weeks before planting the land should be cross-ploughed, more shallowly than the first ploughing, and thoroughly worked to a fine tilth by the use of disc or drag-harrows, spring-tooth harrows, etc. Where the soil is light or in good mellow condition the second ploughing is sometimes omitted and less working by harrow is necessary. On the lighter soils rolling either before or after planting may be advantageous in order to consolidate the land. On light soils too the spring tooth-harrow set in as deeply as possible may well replace the second ploughing, especially where a green-manure crop has been turned under before planting irrigated potatoes in August.

Planting.—When the soil has been worked up to a really fine tilth furrows are usually opened at 30 to 36 inches apart by means of a ridging plough. The largest producers of main crop potatoes in this Colony, who dress their potato lands with 18 to 20 tons of farm manure and 600 lbs. of a complete fertiliser per acre, employ a spacing between the ridges of 30 inches and between the plants in the rows of 12 inches. However, as a rule, growers in Southern Rhodesia do not apply very heavy dressings of farm manure and fertiliser and a spacing of 36 inches between the ridges and 15 to 18 inches between the plants in the ridges is more usual. The question of the proper spacing of the crop is not only influenced by the level of fertility of the soil, but by the size and vigour of the seed. As a rough rule it may be said that the smaller the "seed" the closer must be the spacing in the rows. Whereas normal sized seed, weighing 2 to 2½ ozs. each, might be best spaced 15 inches in the rows, it might be better to close the spacing to possibly 9 inches when the tubers weigh as little as ¾ oz. each.

Very steady oxen or mules are required for drawing the furrows and for ridging the land if the work is to be done properly and good native drivers are also necessary. However, good drivers and steady oxen are not always available and farmers sometimes resort to planting in the furrow behind a 3-furrow disc plough. This method should never be used if it can be avoided, since it results in uneven depth of planting, and the crop is more difficult to lift either by

digging or ploughing. Furthermore, where irrigation is practised the leading of the water onto the land is extremely difficult if it is not well ridged, and uneven watering and local water-logging of the ground will inevitably take place. On irrigated land the furrows should run as nearly along the contours of the land as possible, as the irrigation of the crop is thereby facilitated, a very important matter where unskilled labour is employed.

If the soil is at all heavy or liable to "pack" if worked when wet, as is usually the case with the red and chocolate-coloured soils of the maize belt, it is advisable and usually essential to carry out the planting operations whilst the soil is dry. In order to avoid this difficulty the main crop may be planted in October before the advent of the rains, and a further considerable advantage of such early planting is that the tubers are protected from infestation by the tuber moth, the most serious pest of the crop in this Colony. This is the practice now adopted by the largest growers of main crop potatoes. After planting the tubers in the furrows the ridges are split back immediately by means of a ridging plough. There should be no delay in covering the "seed," since the tubers are liable to sun-scald whilst exposed and cut "seed" in particular are very liable to dry out excessively. Where oxen supply the tractive power, to avoid damage of the "seed" when splitting back the ridges the tubers may be pushed lightly into the sides of the furrows. If this is done it is well to place the tubers with the "rose" end uppermost so as to facilitate their germination and early growth.

Messrs. Newmarch and McLean, farming near Salisbury, utilise a so-called potato "drill" (illustrated in fig. 1) which is much used in the potato-growing districts in Scotland and is the first of its type to be employed in this Colony. It consists of twin ridging ploughs, with two receptacles for fertiliser above them, which drop the fertiliser in the furrows behind the ploughs. The rate of delivery of the fertiliser and the depth of working are both readily adjustable. This implement does excellent work and saves a considerable amount of time and labour normally expended in spreading the fertiliser in the furrow. It is also employed in splitting back the ridges to cover the "seed."

Date of Planting Main Crop.—The main crop may be planted from October to January, though it is not advisable to postpone planting after the middle of December unless necessary. On the lighter soils, which show no tendency to "pack" when worked in a wet condition, the best time of planting is from the end of November to mid-December. On the heavier red and chocolate clay loams the danger of packing the soil is so great that it may be necessary to plant in October before the advent of rains. Imported "seed" often does not arrive in time to allow planting before January, but this is usually too late to obtain the best yields. However, as this crop is generally only raised for "seed" the question of high yield is not of such great importance.

Depth of Planting.—It is important when planting is done in the early spring in dry soil before the arrival of the rains, that the tubers should be buried deeply, so that they and the soil surrounding them do not become unduly heated by the sun. If this is not done there is great danger, after light showers, of the tubers being destroyed by a form of rot, which is described fully in the notes on potato diseases by the Plant Pathologist (published elsewhere in this issue of the Journal).

The tubers should be planted so that, after the splitting back and pulling down of the ridges, there is at least 4 to 5 inches of soil above their upper surface.

Where planting is done in moist soil and more rain is likely to follow, the depth of planting may be less.

Planting under Irrigation.—Various modified methods of planting and covering the "seed" are practised where the crop is irrigated, and the reader may have his own method, but the following are those normally employed with success (1) The tubers, after placing them in the bottoms of the furrows, are covered with soil to a depth of about two inches by pulling down the soil into the furrows with hoes and the water may then be led down the furrow directly over the potatoes. As soon as the plants have made sufficient growth to enable them to be earthed up, the original ridges are fully split back and the water is then led along the flanks of the ridges in which the plants are now growing. Where eelworms infest the soil it is well not to use this method and the second method may be employed.

(2) The tubers are planted on the lower side of the furrow, holes being made to receive them about 3 inches up from the bottom of the furrow. They are covered with about 2 inches of soil and the water is then led along the furrows. When the crop is cultivated, the soil is gradually brought down from the top side of the furrow to the lower side, about a third at a time, covering the tubers deeper each time until the original ridges are completely split and the plants come in the middle of the new ridges thus made.

This method is particularly to be recommended where the soil is known to be infested with eel-worms, since it assures the tubers being kept out of the wet bottoms of the furrows, where they are most liable to damage by this pest.

(3) A third method which is used, particularly on the more hilly land, is to plant the tubers in shallow holes made with a hoe in the bottom of the furrow. They are then covered and the water led down the furrow and over the tubers until ridging renders this no longer possible.

Date of Planting the Winter Crop.—The irrigated winter crop may be planted in frost-free situations as early as the end of February. It then commences growth with the last rains of the wet season and after the latter cease the crop is irrigated. Excellent prices may sometimes be obtained for crops planted as early as this, but the yield is usually light. In frost-free land the crop may be planted at any time from the cessation of the summer rains up to the end of August or the beginning of September, but September planted crops seldom yield well owing to the attacks of "Early Blight" and the great heat in October and November when the plants are still young.

In situations where frosts are liable to be severe, it is not advisable to commence planting until early August, though many growers gamble successfully on the absence of severe frost and plant somewhat earlier. Earlier plantings may be partially protected from frost by covering the ground after planting with grass. This layer of grass will help to protect the young plants from moderate, but not from severe frosts.

Transplanting.—It is not generally known that the transplanting of potatoes, even after they have made strong

A strain of up-to-date potatoes selected for high yield over a period of six years since importation of the original "seed." Note vigour of growth. Agricultural Experiment Station, Salisbury.

Edible canna interplanted with dolichos beans, Agricultural Experiment Station, Salisbury, February, 1930.

growth can be carried out quite successfully. On occasions this may be useful, as for instance, when the stand of the new crop is poor and a volunteer crop has grown up from tubers left in the ground from the preceding year's crop. The latter may then be utilised to fill the blank places left by failures in the current year's crop. Such transplanting must, of course, be done into wet soil and care must be taken that the roots and rhezomes are not injured and that the soil is well firmed down round the roots after transplanting.

(To be concluded.)

Loughborough College.

BRITISH EMPIRE SCHOLARSHIPS.

The entrance examinations for the award of British Empire Scholarships in the Faculty of Engineering, Loughborough College, have now been completed and awards made. The scholarships are tenable at Loughborough for the full period of the Diploma Course, and the governors of the college have approved the following awards for 1931-1932.

1. Wain-Heapy, G.R.J., St. Joseph's College, Naini Tal.
2. Dossor, F., Hymers College, Hull.
3. Jenkins, H. J., Wellingborough School.
4. Gaul, R. J., Plumtree School, S. Rhodesia.
5. { Favel, S., Royal Commercial Travellers' Schools, Hatch End.
   Green, M. I. F., Giggleswick School, Settle.

These scholarships are open to all British subjects resident in any part of the Empire, and are of the value of £75 per annum.

Applications were received from a large number of the public and secondary schools in England, Africa, Rhodesia, Australia, India, and the Federated Malay States.

Some Common Diseases of Potatoes in Southern Rhodesia.

By J. C. F. HOPKINS, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

Throughout the world potatoes are subject to a large number of diseases, many of which are a constant menace to the whole potato growing industry in the country in which they occur, and were adequate control measures not maintained by legislation, there is little doubt that the production of an economic crop would become an impossibility. Southern Rhodesia is singularly fortunate in the freedom which it enjoys from the more serious potato diseases, and, although our growers have certain obstacles to overcome in maintaining the health of their crops, yet the avoidance of most diseases is a comparatively simple matter. The use of suitable sprays and selection of "seed" along correct lines will overcome the principal troubles which are experienced locally.

FUNGUS DISEASES.

Early Blight (*Alternaria solani* (Ell. & Mont.) Jones and Grout).—This disease occurs on all rain-grown potato crops in the Colony and is the cause of big reductions in yield wherever potatoes are grown on old-fashioned lines. It is well known by all potato growers, but is recognised as a disease by very few. What is usually supposed to be the normal maturing of the crop is in nearly all cases the effect of attack by Early Blight, which reduces the growing period of the plants by from three to six weeks, depending on climatic conditions.

Symptoms.—The first indication of the disease is the appearance of small, dark brown spots upon the leaflets at the time of flowering or a little beforehand. The spots are

first seen on the lower leaves and are not very conspicuous, but soon the affected leaflets begin to turn pale green or yellowish as the spots enlarge and finally the leaves wither up, many remaining attached to the haulms. Spotting spreads upwards on the plants until the youngest leaves are attacked, by which time the whole plant has been reduced to a mere skeleton of dried leaves and haulms.

Conditions favouring the Disease.—Early Blight usually makes its appearance in early or late January, depending on the time of arrival and distribution of the first rains. Early plantings are usually free from disease until well developed, but the late-planted crops, from imported "seed," are attacked early on in life. Severity of attack is influenced almost entirely by atmospheric humidity, so that the disease is most destructive during very wet weather; it is a negligible factor in the cultivation of irrigated crops during the dry season.

Control.—The use of fungicidal sprays is found to give adequate control of Early Blight and in this connection Bordeaux Mixture of strength 4-4-50 (1) or, if there is difficulty in obtaining water, 20 per cent. copper-lime dust are recommended. It is found that, in most seasons, three sprayings are necessary, commencing when the first plants are coming into bud. Subsequent sprayings should be given at intervals of about three weeks, depending upon weather conditions. The benefits to be derived from correct spraying have been demonstrated commercially on a number of occasions and it is no exaggeration to say that increases of over 100 per cent. in yield are often obtained.

Black Scurf (*Rhizoctonia solani* Kühn).—This disease is also of common occurrence in Southern Rhodesia, but is not as consistently destructive as Early Blight. It is caused by the fungus *Rhizoctonia solani* which normally lives and feeds in the soil but sometimes becomes parasitic upon the tubers, causing rough scabs or scurf or producing hard black lumps of varying sizes on the surface of the skin.

Symptoms and control measures by the use of corrosive sublimate "seed" treatment have already been described in this Journal (2) and need not be dwelt upon here.

Wilt (*Fusarium culmorum* (W. G. Sm.) Sacc. and *Bacterium* sp.).—An unimportant wilt which occurs in isolated areas during very wet weather has been reported upon a few occasions. It is associated with the fungus *Fusarium culmorum* and a bacterium which has not yet been described. Inoculation experiments with the latter have shown that it is capable of killing the "eyes" and young sprouts and in this way gaining entrance to the tuber which it reduces to a foul smelling, slimy mass. The fungus apparently acts as a wilt producer by attacking the haulm, which the bacterium is unable to do by itself.

Affected plants have been found to recover when dry weather obtains so that control measures have not been found to be necessary.

Tuber Rot (*Fusarium solani* App. & Woll.).—Rotting of "seed" in the soil occurs sometimes when the tubers are planted very early in the season before sufficient rain has fallen to soak the land thoroughly and this is followed by a prolonged, hot, dry period of a fortnight or so. Such conditions are not of infrequent occurrence in the Colony and appear to be responsible for an appreciable loss of early planted "seed."

The fungus *Fusarium solani* has been isolated from diseased tubers on several occasions, and has been shown to be capable of producing a tuber rot under the hot conditions of a glasshouse. The fungus is usually followed by bacteria which cause a creamy-white, evil smelling internal rot. In cases of severe infection, the stand may be reduced to as little as 1 or 2 per cent.

The disease may be prevented by planting only after good rains have fallen or by planting the tubers some four or five inches deep in the soil.

MISCELLANEOUS DISEASES.

Brown Fleck or Sprain.—This disease, which is well known throughout the world, has for a long time puzzled research workers and even now, many points associated with it are not known with certainty. In 1928, a comprehensive paper was published in England (3) describing the disease fully and attributing it to two bacteria. Confirmation has

Fig. 1.

Top : Fig. 2.

Crop grown from "eighth-from-imported" seed which has been selected.

Bottom : Fig. 3.

"Eighth-from-imported" seed which has not been selected and has completely degenerated.

not been forthcoming from South Africa and not much is known either about its cause or the conditions influencing its development, so that definite recommendations for treatment are not yet made.

The symptoms of brown fleck are the presence in the flesh of the tuber of rusty brown, isolated spots, streaks or irregular blotches in which cavities are sometimes to be found. The outside of the tuber is quite normal in appearance and no indication of the disease is to be found until the tuber is cut. When cooked, the internal lesions turn black and hard, making the potato unsuitable for table use.

Since the evidence so far obtained with regard to the influence of soils and infected "seed" upon the development of the disease is contradictory, the only recommendations which can be made for control are renewal of "seed" and changing of lands.

Frost Injury.—Occasionally in irrigated crops, small patches of plants may be found with blackened and flaccid leaves. Such plants have been affected by frost, and no infectious disease is present. In exceptional instances, such as was experienced last season, large areas may be killed by a sudden and unseasonable drop in temperature. Sites which are subject to visitation by heavy frosts should not be planted to potatoes.

White Spotting of Tubers.—Each season, tubers which possess a number of raised white or corky spots upon the skin surface are received in this laboratory and are often thought to be infested by eelworm. The intumescences are not, however, caused by any parasite, but by the internal tissues being forced through the pores of the skin as the result of swelling due to excessively damp conditions under which the plants are living.

VIRUS DISEASES.

Degeneration of potato "seed" is a well-known phenomenon in Southern Rhodesia, but the causes of degeneration do not appear to be understood by the farmer. It is generally thought that the reason for "running out" of "seed" is the unfavourable climate in which the crops are grown. Although there does appear to be some climatic effect upon the

virility of imported potatoes, yet the chief causes of degeneration are undoubtedly virus diseases; that is, diseases similar to mosaic in tobacco. The most potent of the viruses which are known to occur in the Colony is that which produces the symptoms known as Streak, and which brings about the premature death of numerous varieties of potatoes, reducing their yields practically to nothing within two or three years. Fortunately the Up-to-date variety is very resistant to (or more correctly a "carrier" of) the Streak virus, so that a succession of plantings of these tubers may be made over some four or five years before they become commercially useless; which fact probably accounts for the popularity of the Up-to-date variety in Southern Rhodesia. Even so, the effect of the virus diseases to which this variety is susceptible is made manifest in the first season's crop, although the symptoms are almost certainly overlooked by the grower. Faint streaking of veins together with mottling, spotting and curling of leaves are not readily discerned by the untrained observer, but their presence, none the less, is the first step on the downward path of degeneration which is responsible for the necessity for continual importation of fresh "seed" from overseas.

There is no need to describe fully the symptoms of what is generally known as Crinkle, but a glance at Fig. 1 will show the serious nature of the disease, which becomes progressively more acute as "seed" from diseased plants is sown year after year. With freshly imported "seed" it usually requires two seasons under field conditions for the "leaf-drop," shown in the illustration, to appear in quantity, but if the same seed be placed in pots in a glass-house and subjected to temperatures ranging from 70 to 125 degrees Fahrenheit, streaking and leaf-drop have been observed to develop within six weeks from time of planting. Conversely, imported Scotch tubers planted on the high veld in cool localities appear to retain their virility for a longer period than those grown in hotter districts, and it is thought that high temperatures are responsible for the rapid degeneration in Southern Rhodesia of potatoes which do not "run out" in Scotland.

That is to say, the Up-to-date variety, for example, when grown under temperate conditions is not adversely

affected by the Streak virus, although it is known to carry this virus in the sap, but when brought to a less favourable environment reacts in the manner described above. Furthermore, it is known that several of the more common degeneration diseases can be transmitted to healthy stock from affected potato plants by means of the green fly, or aphis (*Myzus persicæ*), and it is strongly suspected that wild plants and tobacco are also reservoirs of infection, so that it is not surprising to find imported "seed" deteriorating within a few seasons unless some attempt is made to retain only vigorous tubers for planting.

Selection has been successfully carried out in Southern Rhodesia by a few people over a number of years and the writer has seen first-class crops grown from "fourteenth-year-from-imported" seed. The possibility of maintaining the virility by selection is well illustrated in Figs. 2 and 3, which are photographs of plots at the Agricultural Experiment Station, Salisbury, planted with progeny of "seed" imported in the year 1922-23, *i.e.*, "eighth-from-imported." Fig. 3 shows what becomes of a strain in which virus infection is allowed free rein, whilst Fig. 2 illustrates the beneficial results of selection. It is not only on government experimental stations that such selection can be carried out, for, by selecting in the field and discarding hills which do not conform to type, plants which are very susceptible to virus diseases can be automatically eliminated and only the strongest strains retained. Try it and see.

FOREIGN DISEASES.

The most serious and widespread potato diseases have not yet made their appearance in Southern Rhodesia. These include Late Blight or Irish Potato Blight, the cause of the great Irish famine; Wart Disease; Common Scab and Powdery Scab. Bacterial Wilt has been recorded in the Colony, but no case has been seen for at least five years except in a few rejected consignments of imported "seed."

The fact that these diseases do not occur locally is no guarantee that they will not be introduced at some future date, so that it is to the benefit of all growers to use only the very best of "seed" and to obtain a certificate of freedom from all the above diseases before importing potatoes into the Colony.

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2. ————"Two Common Diseases of Potato Tubers in Rhodesia." *Rhodesia Agricultural Journal,* xxvi., 3, 1929. Bulletin No. 732.
3. Burr, S.—"Sprain or Internal Rust Spot of Potato." *Ann. App. Biol.* xv., 4, 1928.

Gwebi Produce Prices.

Salisbury White, seed maize ...	42/- per bag of 200 lbs.
Salisbury White, seed maize (tips and butts)	15/- per bag of 200 lbs.
Hull-less oats	40/- per bag of 150 lbs.
Spanish Bunch nuts (unshelled)	15/- per bag of 75 lbs.
Spanish Bunch nuts (shelled)	60/- per bag of 180 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Majorda seed	1/1 per lb.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

Phosphorous Feeding to Live Stock.

An interesting account of the results achieved by feeding phosphatic supplements to cattle at the Veterinary Research Station at Vryburg is given in the issue of "Farming in South Africa" for May, 1931.

Different compounds of phosphorous in varying amounts were fed to six groups, each of eight nine-month-old oxen, while a seventh group was kept as a control and given no phosphorous.

The cattle were dosed daily except Sundays, and the results of two years' work are shown graphically below:—

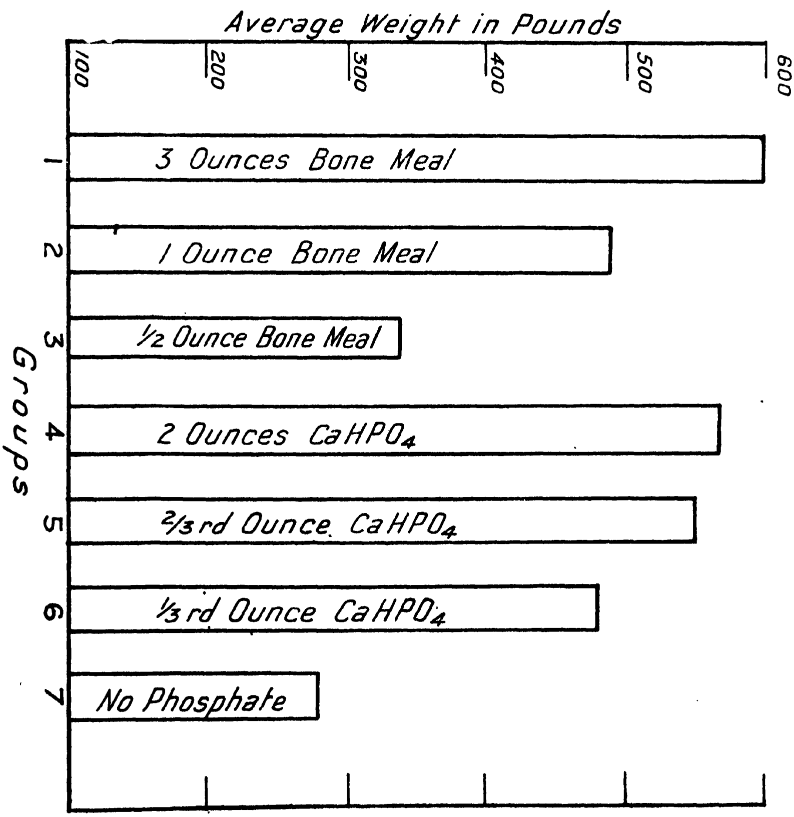

Figure showing comparative gains of different groups by feeding phosphates.

[By courtesy of *Farming in South Africa.*

The difference between the phosphate and no phosphate groups is remarkable. A point of much interest is that a daily dosage of two-thirds ounce calcium phosphate (Ca HPO 4), at a yearly cost of 2s. per head per year, has given only slightly inferior results to 3 ounces of bone meal, costing 6s. 10d. per year. This saving does not take into account the economy effected in the cost of transport by using the smaller quantity of calcium phosphate.

The administration in practice of phosphatic supplements is a problem. As a rule the materials are given in a lick. This is not wholly satisfactory as the "cravers" and the stronger animals usually get more than their share. On this account a system of daily dosing in a wooden crush, wide enough to allow the cattle to pass in a single file, is followed at Vryburg. The animals are driven in at one end and made to stand so their heads all face the same direction. One man then opens the animal's mouth while another puts a spoonful of known weight on the back of the tongue. Once the stock become accustomed to the procedure a large number can be dosed in a short time and, where practicable, this method is preferable to the ordinary method of giving the cattle a bone-meal or calcium phosphate lick.

Milk Recording in Southern Rhodesia.

The Government milk recording scheme has for its object the determination of the value of the cow from the economical standpoint of milk production, and also for the rapid improvement of the dairy stock. Milk recording enables owners of dairy herds to practise individual selection in breeding, based on actual milk production.

The milk recorder visits each owner of recorded herds once in every 30 days and stays two days in the case of pedigree herds and one day in the case of grade herds. During this visit he weighs the milk of each cow and tests the milk

DAIRYING AT HALSTEAD FARM, NEAR BULAWAYO: PROPERTY OF MR. G. A. LYONS.

Top: de Grendel Hancy produced 17,753 lbs. of milk in 300 days. Middle: Vermaak's Kraal Matje produced 16,266 lbs. of milk from three quarters only in 300 days. Bottom: Some of the herd.

[illegible] of the Government Milk Recording Scheme.

for percentage of butterfat. These figures are entered in a book and a copy given to the farmer.

In the development of a dairy herd it is essential that accurate breeding and production records be kept because records form the only accurate and safe basis for judging dairy cattle. From the view point of the feed bill alone production records are invaluable; this enables the owner to feed according to production, and not merely the same amount to each member of the herd.

In this Colony there are far too many unprofitable cows, commonly known as "boarders," which do not produce sufficient milk to pay for the food they consume; they also produce unprofitable calves. One cannot expect to develop a high producing herd unless the unprofitable cows are weeded out. The keeping of milk records has shown time and again that one cow is making a profit whilst the one by her side is being kept at a loss that equals the profit of the other. The culling of such unprofitable cows is made possible to a greater extent by the aid of the recording scheme, and the profits of the herd are greatly increased if the practice of culling is rigorously practised. Undoubtedly the most satisfactory guide in the selection of a dairy cow is a record of her production, showing the quantity of milk she has produced in a given time and the average percentage of butterfat of the milk. Progressive dairymen are realising the advantage of keeping records of production, not only for their own guidance and information in determining which of the cows are profitable and which are not, but also as a means of a guarantee of merit to prospective buyers. With these records of production to guide him even a novice is able to make a satisfactory selection of cows, whereas the most expert judge of dairy stock may frequently make a poor selection if these figures are not available.

Red Canadian Wonder and Natal Sugar Beans.—There is no market in the United Kingdom for coloured beans for human consumption, but consignments of these beans could be disposed of for feeding cattle or poultry at about £4 per ton c.i.f.

Tepary Beans.—These are too small for the United Kingdom market, but they should be saleable either in Canada or on the Continent of Europe.

In connection with the above valuations, the importers pointed out that the price of beans at the time was abnormally low.

Enquiries were also made to ascertain whether the Natal Sugar beans and possibly the Red Canadian Wonder beans could be utilised for the preparation of soup powders or similar food products, for which purposes the external colour might be no disadvantage. Firms manufacturing such preparations who were consulted stated, however, that such beans were not suitable for their purposes. Their reports confirmed the views of the importers that there would be no appreciable market in the United Kingdom or on the Continent of Europe for such beans for human consumption.

REMARKS.

It will be seen from the preceding market reports that the Algerian White bean is the only one of these five samples which would be saleable for human consumption in the United Kingdom, and that even in this case the quality is below that of the best types of similar beans already on the market.

The Canterbury White and Tepary beans would not be acceptable in the United Kingdom for human consumption owing to their shape or size, and the Red Canadian Wonder and Natal Sugar beans are unsuitable on account of the colour of the seed coat. Consignments of these four types of beans could be disposed of in the United Kingdom market for cattle feeding purposes, but would only realise a low price. A better market might possibly be found for the Canterbury White and Tepary beans on the Continent of Europe.

With regard to the demand in the United Kingdom for beans for human consumption, there are three well-known and popular types, viz.:—

Madagascar Butter Beans;

Haricots: Danubian or Japanese (Ohtenashi from Japan or Kotenashi from Korea);

Rangoon White Beans.

These varieties are well established in the market and it is almost impossible to sell consignments of beans which do not conform to one of the three standard types. In valuing consignments, the factor of first importance is the colour of the seed coat; the internal colour is not taken into consideration provided it is not abnormal. Other points upon which the value depends are uniformity of size, freedom from insect attack, absence of "yellow eye" and weathering marks, and cleanness of sample.

The Madagascar butter beans, which meet the demand for a large bean, are in a class by themselves on account of size, but in addition to size the colour of the seed coat is important. Of the smaller beans, the Rangoon are sold in large quantities, but fall much below the Danubian and Japanese in value on account of their inferior colour.

In view of these considerations it would seem desirable, if it is proposed to grow beans in Rhodesia for export to the United Kingdom, to experiment with Madagascar, Danubian and Japanese beans, and if conditions prove favourable to encourage the production of one or more of these varieties for shipment.

Salisbury Agricultural Experiment Station.

ANNUAL REPORT, 1929-30.

(Continued.)

By H. C. ARNOLD, Manager.

(Published with the approval of the Chief, Division of Plant Industry.)

Ground Nut Fertiliser Trials.—The cultivation of this crop having increased considerably during the past decade, the question has arisen as to whether farm manure or fertiliser can be profitably employed to increase the yields of nuts.

The results of experiments with farm manure are recorded in the annual report for this station for season 1926-27. Owing to the small increases obtained, it was concluded that the limited amount of this manure usually available could more profitably be used on other crops.

Experiments with artificial fertilisers were commenced in season 1927-28 when the following dressings were applied:—

	Cost of fertiliser dressing estimated on 1931 prices.
(1) Superphosphate, 200 lbs. per acre ...	12/-
(2) Superphosphate, 200 lbs. per acre, plus Muriate of Potash, 50 lbs. per acre ...	19/-
(3) Superphosphate, 200 lbs., Muriate of Potash, 50 lbs. and Sulphate of Ammonia, 50 lbs. per acre	26/-
(4) Half dressings of No. 3	13/-

Each of the above dressings was applied to duplicate plots and an untreated plot was grown between each of the fertilised plots. The tabulation given below shows the average increased yields obtained during two seasons from the pairs of plots which received fertiliser.

Increased Yields in lbs. per Acre.

	Fertiliser dressings.			
Season.	(1)	(2)	(3)	(4)
1927-28	188	325	200	100
1928-29	125	69	263	25
Totals for two seasons	313	394	463	125
Value of increase at 1d. per lb. ...	26/1	32/10	38/7	10/5

Second Series.—This series was commenced in December, 1928. The same fertiliser treatments were applied as in the first series, but the plots were arranged in the form of squares on a chessboard. Alternate plots received no fertiliser treatment and each of the dressings was applied to duplicate plots. Thus, eight plots received fertiliser while eight check plots were not treated in any way.

Increased Yields in lbs. per Acre.

	Fertiliser dressings.			
Season.	(1)	(2)	(3)	(4)
1928-29	152	120	96	32
1929-30	104	64	112	40
Totals for two seasons	256	184	208	72
Value of increase at 1d. per lb. ...	21/4	15/4	17/4	6/-

Third Series.—At the request of the Enterprise Farmers' Association, basic slag was included in this series of experiments, but as the results of the previous experiments indicated that nitrogenous fertiliser had no beneficial effect, the treatments were rearranged as follows:—

(1) Basic slag, 200 lbs. per acre.

(2) Superphosphate (19 per cent. P_2O_5), 200 lbs. per acre.

(3) Superphosphate, 200 lbs., plus Muriate of Potash, 50 lbs. per acre.

(4) No fertiliser.

Each treatment was given to four plots, each 1-32 acre in extent, arranged in the form of a Latin square and the yields of each of the plots are shown below for season 1929-30.

Yields in lbs. per Plot of 1-32 *Acre.*

	(1)	(2)	(3)	(4)
	63	38	52	47.5
	64	62	70.5	37.5
	62.5	62	53.5	63.5
	55	71	53	61
Total yields of four plots	244.5	233	229	209.5

Examination of these yields shows that there was considerable variation among the yields of plots treated with the same dressing and that two of the plots which were not fertilised yielded as much as some of those which were fertilised. Further, statistical analysis of these results by the method evolved by R. A. Fisher shows that a difference of more than 27 lbs. between the totals for four plots is required to establish significance, whereas the mean total yields of the fertilised plots show an increase of only 26 lbs. Further statistical tests indicate that the apparently significant increase of 35 lbs. in favour of the dressing of basic slag may be largely due to chance and that this result should be regarded with reserve. The average indicated increase due to fertiliser is 208 lbs. per acre. At 1d. per lb. this would be worth 17/4, which leaves a small margin of profit on the outlay for fertiliser. There is no indication of response to potassic fertiliser in the second and third series.

These experiments seem to show that while phosphatic fertiliser may be profitably used on soils of somewhat low fertility, there is little response to fertiliser treatment on land which has been maintained in a moderately high state of fertility, and that ground nuts do not respond to phosphate treatment to nearly the same extent as maize and several other crops. It is therefore considered that under normal conditions of soil fertility it will be found more profitable to

follow with ground nuts after some other fertilised crop rather than to apply fertilisers direct to the nuts.

POTATO TRIALS.

Green-Manure for Potatoes.—It is well known that this crop cannot thrive on soils which are insufficiently friable and aerated, and that heavy dressings of farmyard manure are usually necessary to ensure satisfactory yields. Apart from providing plant food, the manure increases the organic matter supply and the porosity of the soil enabling it to absorb air and moisture more readily. Farm manure is usually very limited on most farms in this Colony, and the trials now described were designed to ascertain whether green-manure crops could be used to supplement moderate dressings of farm manure.

Velvet beans and sunn hemp have been grown as green-manure crops and an intermediate plot has been cropped with oats for hay. Manure at the rate of six tons per acre has been applied to all plots at the time of the winter ploughing, and 200 lbs. per acre of bone and superphosphate has been given in the furrows at planting time. During the season under review there was a very considerable difference in the colour of the top growth of the potatoes in favour of the green-manured plots, which also seemed to withstand the effects of drought better than the plot which received no green-manure.

The following table shows the results of four years' experiments, omitting season 1927-28 when the crop was severely damaged by insect pests.

Yields of Tubers in Bags of 150 lbs. per Acre.

Treatments	1925-26	1926-27	1928-29	1929-30	Average over 4 seasons
Velvet beans p.u.	94	92	62	108	89.0
Sunn hemp p.u.	88	93	57	95	83.2
Oats reaped	78	84	62	90	78.5

These experiments indicate an average increase of 7.6 bags per acre in favour of the green-manurial treatment. During the season under review the response has been somewhat greater than it was in the three previous seasons. The

reason for this is probably due to the fact that the planting of the potatoes was delayed until December, by which time the green-manure had become well rotted and in that condition the crop was able to derive greater benefit from it than on previous occasions, when the tubers had been planted in October. It appears, therefore, that when land is being green-manured for potatoes, precaution needs to be taken to allow ample time for the green material to decay before the potato crop is planted, and if this point is neglected little benefit is likely to be derived from the treatment.

Size of "Seed" Trials.—These trials were repeated again for the fourth year, and the results corroborate those obtained in previous seasons, which were fully reported on last year. The yield obtained from the large tubers was more than twice as much as that obtained from small tubers.

Large Tubers cut in Halves versus Whole Medium-Sized Tubers.—When heavy crops of potatoes are produced, a proportion of the tubers are usually too large for marketing as first-grade table potatoes, and in view of the fact that large seed tubers have consistently given better returns than small tubers, this experiment was laid down to ascertain whether it would be practicable to utilise the extra large tubers for seed purposes after cutting them in halves.

A number of tubers, each weighing ten ounces or more, were selected from stock which had been grown during the previous summer and stored for several months. These were cut lengthwise and after dressing the cut surface with slaked lime they were planted on 20th November in rows alternating with other rows in which whole tubers weighing two ozs. each were used. Twenty per cent. of the cut seed failed to grow and their yield was 8 per cent., or 2½ bags per acre less than that from the whole tubers.

The reduced yield was probably due to the reduced stand, and success with this method of using large tubers appears to depend on the vitality of the tubers at the time of planting. The vitality of the tubers used in this experiment had become considerably impaired through storage for several months, and it is reasonable to assume that better results than those indicated might attend the use of fresh tubers. On the other hand some 15 to 20 bags per acre more "seed" would be

required, so the use of large tubers for this purpose could not be recommended except in the case of growers who find they are unable to dispose of out-size potatoes at a reasonable price.

All the tubers used in this experiment were of a strain which was imported from Great Britain seven years previously.

(To be continued.)

Poultry Husbandry in Southern Rhodesia.

THE IMPORTANCE OF GREEN FOOD.

Issued by the Poultry Branch, Department of Agriculture.

The results of not supplying sufficient green food to poultry are (1) infertile eggs, (2) weak germs, (3) weak chicks, (4) ill-health and death, (5) fewer eggs, (6) smaller eggs, (7) pale coloured yolks, (8) retarded development, (9) retarded maturity.

The above results (there are others) are sufficient to prove to the poultry keeper of what great importance it is to him to see that his birds have sufficient green food; in fact they can hardly have too much. Dealing with No. 4 above, a poultry adviser was called in to see some chicks recently which were dying by several per day. The sole cause was lack of green food (lack of vitamin A). This causes a disease in fowls of all ages, but especially in chicks when they are growing their crop feathers. It is called, for want of a better name "Nutritional Disease." The symptoms are not unlike nasal and eye roup. It has sometimes been called

"Nutritional Roup," which is quite a misnomer, for there is no smell of roup, nor is the roup bacillus present.

The symptoms are as follows:—Loss of appetite, listlessness and weakness, swollen and watery eyes. Later the eyes become filled with a cheesy, pale yellow matter. The birds usually lie on their sides in a comatose condition till they die. Small yellow spots are sometimes seen in the mouth and throat. These are different from the patches seen in diphtheritic roup, which are of a dirty yellow colour and large. Such cases don't need medicine, they need fresh green food which is rich in vitamin A. (Cod Liver Oil also contains vitamin A.)

If chicks and fowls have access to plenty of fresh green food, this condition never occurs. Sometimes, however, enough green food is not available, due to dry weather or lack of growing vegetation within ranging distance.

Separated milk to some extent supplies the vitamin A that is necessary, but not in the quantity green food does, and skim milk has not as abundant a supply of vitamin A as whole milk has.

Cod Liver Oil given to sick birds in 5 to 10 drop doses or mixed in the mash in the proportion of 5 per cent. by weight improves conditions slightly. It contains vitamin A, but again not in the quantity green food does. The only preventative of and sure cure for this ailment is plenty of fresh green food.

There is no doubt that many hundreds of fowls and chicks die in this colony from the above cause, and naturally during the dry season. It is a waste of money and time and labour to hatch more chicks than the owner knows he can feed with sufficient green food later.

EUROPEAN OWNED CATTLE IN SOUTHERN RHODESIA IN 1930 COMPARED WITH 1929.

(Compiled by the Government Statistician)

Sex, Age, etc.	December 1930 (Provisional)	December 1929 (Actual)	Increase (+) or Decrease (-) in 1930 compared with 1929.
	No.	No.	No.
Cows, regularly milked	52,975	50,809	(+) 2,166
Cows, other	240,874	233,854	(+) 7,020
Heifers over 1 year	127,715	128,510	(-) 795
All calves under 1 year	153,650	148,192	(+) 5,458
Bulls, in use	8,604	8,766	(-) 162
Other Bulls	4,560	4,490	(+) 70
Trained Oxen	110,583	116,805	(-) 6,222
Untrained Oxen	129,496	138,652	(-) 9,156
Yearlings, Oxen or Bulls	81,069	72,085	(+) 8,984
Total	909,526	902,163	(+) 7,363
PURE BRED (included above):			
Cows, regularly milked	2,032	1,976	(+) 56
Cows, other	3,519	3,305	(+) 214
Heifers	2,244	2,330	(-) 86
Calves	2,789	2,623	(+) 166
Bulls in use	3,653	3,339	(+) 314
Bulls, other	1,060	1,271	(-) 211
Total	15,297	14,844	(+) 453

TOTAL LIVE STOCK IN THE COLONY OF SOUTHERN RHODESIA, 1925-30.

Year.	European Owned.	Native Owned.	Total.
	No.	No.	No.
1925	1,006,086	1,095,841	2,101,927
1926	991,216	1,197,466	2,188,682
1927	956,522	1,370,567	2,327,089
1928	905,383	1,420,913	2,326,296
1929	902,163	1,495,803	2,397,966
1930	909,526	1,558,075	2,467,601

Napier Grass.

PENNISETEUM PURPUREUM.

It is interesting to note that this grass which has been favourably reported upon in America, Australia and other parts of the world, is now under trial in India. The following extract is taken from "Agriculture and Livestock in India," which is issued under the authority of the Imperial Council of Agricultural Research.

"This was introduced from Peradeynia, Ceylon, in 1927. It tillers heavily, and it is very easily propagated from cuttings.

"In comparative tests on the Dacca Farm, without irrigation, Napier grass gave an out-turn of 877½ mds. per acre of green feed up till 6th December, and Guinea grass a yield of 467¾ mds. per acre during the same period.

"Napier grass grows quicker than Guinea grass. It is recommended by the Bengal Department of Agriculture, and has been distributed to cultivators. The Home Crofters Association—a co-operative organization started under the Anti-Malarial Society, Calcutta, has taken 6,500 cuttings this year, and the Ram Krishna Mission Home, near Birati, has grown it with great success and relies on it as the main cattle fodder. Over 10,000 cuttings of this grass have been distributed to different districts in the Province. The analysis, as given by the Ceylon Department of Agriculture, gives it a higher place than Guinea grass in nutritive value."

Napier grass is named after the late Colonel Napier, who brought it to the notice of this Department in 1910. It was established at the Salisbury Agricultural Experiment Station from slips planted in March, 1911, and root divisions have since then been distributed far and wide.

Spread of Foot and Mouth Disease.

INFECTION OF VERY MILD NATURE.

The following information in regard to the foot and mouth disease was issued by the Department of Agriculture on 25th July.

There has been a spread of the foot and mouth disease both in Mashonaland and Matabeleland.

Infection is reported on part of the farm Clonmore and Half Ration Farm in the vicinity of Lochard Siding, and the disease has now been found on the west bank of the Mzingwane River at a point two miles south of Mabiles Drift. This is a smaller extension of existing infection. In the Belingwe district the disease is reported running across the Lundi Reserve, already infected.

In the Victoria district, fresh infection is reported on farms Cavan, Austral, Tokwedale, all near Mashaba adjoining the Chibi Reserve. Infection is reported on the Victoria Native Reserve which adjoins the infected farm Lochiel.

In the Gwelo district infection is reported on the farms Game Park and Long Valley near Hunter's Road, and in the Charter district at Maria's Home and Landskroon, South Enkeldoorn.

In Mashonaland there is an outbreak of the disease on Teneriffe Farm, a sub-division of Kinvarra adjoining Mount Hampden junction. The disease is reported on the farm Patterson, a few miles north of Teneriffe, and also on Selby Farm in the Mazoe district and on the farm Umsasa, and further north on the farm Frogmore in the Umvukwe Reserve.

Infection is reported on Pembi Farm, a sub-division of Frogmore on the west, and in the Chisweke Native Reserve, and near Glendale Siding.

The spread of infection in Mashonaland is due to the importation of certain cattle from Lochard Siding and included for sale on the farm Teneriffe. The infection is, as usual, of so very mild a type as to be scarcely discernible.

The importation into Northern Rhodesia of vegetables, ground nuts and beans has now been prohibited.

Review.

ANOPHELINE MOSQUITOES IN SOUTHERN RHODESIA. 1926-1928.

H. S. Leeson, F.E.S., A.R.San.I.

(Published by the London School of Hygiene and Tropical Medicine. March, 1931. Pp. i-ix, 1-55, Pl. 15. 8s.)

This memoir is a report on investigations made during researches on blackwater fever conducted by Dr. G. R. Ross. It deals first with species of malarial mosquitoes, their relative abundance and their habitats. The largest section of the report is the result of detailed investigations of four species common in the Shamva district, and notes on eleven rarer species or varieties are included.

The section most important and absorbing to the layman contains Mr. Leeson's conclusions and recommendations. Advice is given on improvement of the environment, treatment of the breeding places, measures against adults, and propaganda. The regulations of local authorities, in as far as the standard of buildings is concerned, are criticised from the point of view of mosquito control.

Appendices give keys for the identification of malarial mosquitoes and a list of non-malarial mosquitoes found in the colony. Forty-nine useful photographs of interest to the general public are reproduced.

M.C.M.

Farming Calendar.

August.

BEE-KEEPING.

This month is one of inaction as far as the apiarist is concerned and the hive inmates are best left alone, except that once a week a corner of the quilt on the top crate may be lifted to see if the wax moth has gained a footing, as it may do in a colony weakened by death from sundry causes, and in which case all such frames should at once be removed. Towards the end of the month, with warmer weather, the bees will be tempted out for play spells, cleansing flights, etc., and, according to the season, entrance stops may be opened out slightly with advantage.

In the workshop see that a spare hive or two are in readiness, well painted and ready for use at any hour; also have in readiness any requisite spares, and see that all appliances, such as veil, smoker, fuel, etc., are handy, for swarms may now go and come at a few minutes' notice. Where the bees have been left to their winter quarters with a fair supply of food, good results can confidently be looked forward to for the coming honey flow of the early winter weeks.

CITRUS FRUITS.

The first or spring growth should commence about the middle of the month, and the trees should have a good soaking of water when the new growth commences. If Washington Navel oranges are to set their main crop, frequent irrigations must take place from the time of blossoming up to the rainy season. These irrigations create the necessary humid conditions which are so essential to secure a satisfactory setting of this orange. It is advisable to stimulate the growth of unthrifty trees with an application of one to one and a half pounds of nitrate of soda when the first irrigation is given, this application of fertiliser to be followed by good cultivation. The amount of fertiliser recommended is for mature trees. The packing of late varieties will continue throughout the month. No bearing trees should suffer for want of moisture. Irrigation should not take place immediately before the harvesting of export fruit—at least ten days should elapse between irrigation and the harvesting. This is the best month to cut down citrus trees for re-working to better varieties. As the citrus trees are harvested, all dead, diseased and broken branches and shoots should be carefully cut out before the trees come into new growth.

CROPS.

If not already marketed, the main potato crop will probably be sold about now. Do not forget to grade the potatoes properly according to size. The buyer wants potatoes—table or seed—of even size, not large and small indiscriminately mixed. Select and clean farm-grown seeds ready for next season's planting. Label the bags with name and weight of contents. Build a proper shed for your seed potatoes on the lines recommended in the *Rhodesia Agricultural Journal*. Sort over seed potatoes in store and remove any diseased or rotten. Green oat or barley fodder on wet vleis,

or under irrigation, will become ready for cutting. Press on with ploughing and cross-ploughing. Decide what crops are to be grown next season, and, if you think fit, discuss the matter with officers of the Department of Agriculture. If you have not already effected all your purchases, consider the question of what seed you will require to buy for next season, and discuss the matter with other farmers. If in doubt, consult the Department of Agriculture. In frost-free situations, potatoes can be planted for an early crop under irrigation or on damp land. Cart and spread your farmyard manure and plough it under as soon as spread to avoid loss. If you have any long stable manure, apply it to your heaviest land. The application of phosphatic fertilisers to the land can continue. If you do not already have one, put up an implement shed, even if it be only poles and grass. Keep wagons and Scotch carts under a similar shed or in the shade of trees. Speed up the making and burning of bricks if this is still in progress.

DAIRYING.

At this time of the year the farmer should experience very little difficulty in producing cream of first-grade quality. As a rule the weather is sufficiently cold to prevent cream, produced under average conditions, from undergoing rapid deterioration, and it is not usually necessary, therefore, to separate a cream of such high butter fat content as is required during the warmer months of the year. During the winter months the separator should be adjusted so as to deliver cream testing 40 to 45 per cent. butter fat.

On exceptionally cold days care should be taken that the milk is not allowed to become too cold before separation—for efficient skimming, the milk should be separated immediately after milking and at a temperature not lower than 90 degrees F.

Farmers engaged in butter-making are usually successful in obtaining a good grain and firm body in butter at this season of the year. Cream can quite easily be cooled to churning temperature if placed outside the dairy and exposed to the atmosphere overnight. During cold weather, however, it is more frequently necessary to warm the cream for churning. The most satisfactory method of warming the cream to the proper churning temperature is to place the bucket or receptacle containing the cream in a tub or bath of water at a temperature of about 95 degrees F., stir the cream frequently and replace the water when cold.

This is usually a critical time of the year for young dairy stock. For dairy heifers, weaned calves, etc., there is possibly no better ration than one consisting of maize silage, legume hay and mixed concentrates, and these feeds, if supplied in liberal quantities, should serve to keep the young stock in a thrifty, growing condition.

DECIDUOUS FRUITS.

All plantings of deciduous trees should be completed by now, as the late planting of these trees is generally unsatisfactory. Pruning may be continued up to the middle of the month. It is advisable to water or irrigate all deciduous trees before blossoming; if possible, a second irrigation should be given after the trees have set their fruit. Follow up the irrigations with good cultivation.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillars. The crops should be sprayed immediately with arsenical wash such as lead arsenate powder, 1½ lbs. to 40 gallons of water.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by web-worms. The formula given for potatoes with the addition of ½ to 1 lb. of spreader to every hundred gallons of spray should be effective. If cabbage louse is also present add

tobacco extract, 1 part to 80 parts spray. Do not spray plants of which the foliage is to be eaten within three weeks.

Citrus Trees.—May be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine tobacco wash or Derris.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

VEGETABLE GARDEN.

Plant out asparagus, cabbage, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they show a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fire guards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care, can continue hatching for another month, but not later, for chicks hatched after August are usually slow in growth and weedy. They do not lay till some months after they should, and eggs are few in number; in fact, they are generally unprofitable.

Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (erroneously called tampans) will be found to be the most troublesome. A bulletin on fowl ticks can be obtained upon application to the Poultry Expert, Department of Agriculture. Sand fleas, as most poultry keepers know, are found on the face, wattles, ear-lobes and combs of the birds. Application of carbolised vaseline will usually kill them at once, or two or three applications of any ordinary grease on successive days are efficacious. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly) are in the dust on the floor of the house and that of the run.

The best preventive is a hard floor (preferably of concrete) with no cracks. If this is not possible, the floor and around the house should be treated every week in one of the following ways:—(1) Thorough soaking

with a solution of one teacupful of Kerol, Jeyes, Hycol, Izal, or similar disinfectant to a paraffin tin of water, or (2) with a strong solution of salt and water, or (3) dusting over and raking into the soil a mixture of one part flowers of sulphur and two parts finely powdered lime.

Ducks.—See that the breeding ducks have plenty of water, and if possible also some to swim in. Keep young ducklings out of the hot sun, otherwise there will be many deaths. The same applies to geese and goslings.

Turkeys.—Young turkeys must be protected from cold at night, for this is fatal to them. Give them as much free range as possible, and do not allow them to run round the house or on the same ground as fowls do. Turkeys like clean ground; any that is tainted is very detrimental to them. Let them find most of their food in the bush.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On red soil farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. In dairy herds on any soils whatever, feeding, housing and bedding should not be relaxed. A satisfactory ration for a medium producing cow in full milk is 5 lbs. of maize, 30 to 40 lbs. of ensilage or pumpkin and 8 to 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of ground nuts, crushed with the shell, or oil cake, a very great benefit will be derived. Full particulars of the rationing of dairy cows can be obtained on application to the Department of Agriculture. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. They should be fed a little sweet hay, bean meal, linseed, ground nuts or ground nut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year. In many places now they will be grazing on the early "burns." The ewes and lambs should be given the best grazing available.

TOBACCO.

The seed bed site should be cleared and well ploughed, preparatory to burning and sowing. The usual date of sowing the first beds is the 15th September. Bulletins covering every phase of tobacco culture can be had upon application to the Editor.

VETERINARY.

Redwater and gall-sickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

September.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cyanide—both requiring very careful handling. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are

to be broadcasted and ploughed or harrowed in can be applied. Do not forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30

yards in all directions, and bait this ground thoroughly before sowing—this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on very young fruit. A useful spray against black aphis and thrip is the following:—Nicotine, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuces, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for

killing. Keep the best and get rid of the remainder. It is very advisable to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young

green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

Southern Rhodesia Weather Bureau.

JUNE, 1931.

Pressure.—The pressure remained very high for the greater part of the month and the mean pressure for the month was very considerably above normal.

Temperature.—Mean temperatures were below normal everywhere. This was due to general low temperature and the lowest temperatures recorded were not noteworthy.

Rainfall.—Light winter rains were recorded largely in zones D. E. and F.

A schedule is appended showing the main elements at selected stations.

JUNE, 1931.

Station.	Altitude	Pressure 8 a.m.	Temperature ° F. Absolute.		Mean.			Diff. from Normal.	Humidity, 8 a.m.		Precipitation.		
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min		Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
Bulawayo ...	4,440	...	77	37	68.2	43.9	56.0	−1.3	46.2	45	0.6	−0.20	3
Gwelo	4,632	868.9	75	34	67.0	42.5	54.7	−1.2	46.6	58	...	−0.02	...
Riverbank ...	4,100	...	82	35	74.6	43.2	58.9	−0.3	48.3	64	...	−0.02	...
Essexvale ...	3,828	...	86	32	74.5	38.4	56.4	−1.8	43.3	82	0.07	+0.06	1
Gwanda ...	3,235	915.0	80	32	70.3	40.9	55.6	...	46.2	58	0.05	−0.01	1
Mazunga ...	1,970	957.8	83	36	74.9	42.3	58.6	−4.2	51.7	65	...	−0.01	...
Nuanetsi ...	1,630	...	84	34	75.5	42.1	58.8	...	52.5	71	...	...	...
Between Rivers	3,970	...	83	34	76.2	40.0	58.1	...	47.7	68	...	...	...
Enkeldoorn ...	4,720	...	78	37	67.8	42.2	55.0	−2.9	48.5	64	0.09	+0.06	1
Gatooma ...	3,850	...	79	35	73.0	41.3	57.1	−3.3	49.8	56	...	−0.01	...
Miami	4,090	...	77	40	70.4	44.7	57.5	...	53.5	71	0.03	...	1
Salisbury ...	4,865	860.8	75	37	68.0	42.6	55.3	−1.4	47.9	59	0.03	+0.02	1
Sinoia Citrus ...	3,830	...	78	34	73.2	41.2	57.2	...	49.4	65	...	...	...
Sipolilo... ...	3,900	...	77	40	70.4	46.4	58.4	...	51.1	60	...	...	...
Juliasdale ...	6,070	...	69	34	56.9	41.2	49.0	−4.6	47.0	65	1.45	+1.04	5
Mtoko	4,210	...	75	43	68.5	47.5	58.0	...	50.8	58	...	...	...
Shamva ...	3,170	...	80	35	73.2	42.3	57.7	−2.0	52.2	69	...	−0.01	...
Angus Ranch ...	2,300	...	82	43	73.6	49.6	61.6	...	51.6	71	0.03	−0.08	1
Craigendoran ...	3,000	...	79	36	72.9	42.0	57.4	...	53.1	78	0.11	...	2
New Year's Gift	2,700	...	79	45	72.4	48.9	60.6	...	52.3	71	0.25	...	3
Nyamasanga ...	5,080	...	...	...	...	...	...	...	...	...	...	...	...
Riverdene North	3,700	...	79	28	70.2	37.3	53.7	−4.0	45.7	79	0.15	...	4
Stapleford ...	5,450	...	...	...	...	...	...	...	47.6	80	1.91	+1.27	6
Umtali	3,677	900.3	78	41	68.2	45.9	57.0	−3.0	52.4	66	0.21	...	4
Victoria ...	2,570	903.5	74	30	66.8	35.7	51.2	−4.8	47.9	68	0.11	+0.04	3
Melsetter ...	5,060	855.8	71	39	64.5	44.8	54.6	−1.5	48.7	66	1.03	+0.5	8
Mount Selinda	3,520	...	73	42	65.8	47.4	56.6	−0.5	53.2	72	1.37	+0.77	6

Southern Rhodesia Veterinary Report.

April, 1931.

AFRICAN COAST FEVER.

On 13th April a cow was reported sick on the farm Lorelei, Salisbury district, and subsequently African Coast Fever was diagnosed. The number of animals in the herd is 94 head and 299 in immediate contact and dipping at the same tank. The infected herd is temperatured daily. One animal, treated early in the month for gallsickness and redwater, has given several high temperatures, but smears examined showed no evidence of coast fever.

FOOT AND MOUTH DISEASE.

On 31st March, District Veterinary Surgeon Myhill, Fort Victoria, diagnosed foot and mouth disease on a ranch in the Chibi district, and on the following day this was confirmed by the Chief Veterinary Surgeon. Prior to the discovery of the outbreak infection had been carried to the Victoria and Charter districts, and prior to the discovery of the disease in the latter infection had been transmitted to the Gwelo district. In every case the infection was carried by cattle.

All movements of cattle, even for the purpose of dipping, were suspended in the districts actually affected and in all adjoining districts.

In the Chibi district a rapid and somewhat extensive dissemination of infection speedily occurred and in the other districts a number of outbreaks occurred in the vicinity of the routes traversed by infected cattle prior to the discovery of the original infection.

The disease is of a very mild type and the mortality in adult cattle negligible. In calves up to three weeks old the death rate is somewhat heavy due chiefly to the milk supply drying up.

TRYPANOSOMIASIS.

Four deaths reported amongst infected herds and fresh cases occurred on three farms in the Melsetter district. Four deaths in Hartley district and a few cases reported in Wankie district.

MYIASIS (SCREW WORM) IN CATTLE.

Still prevalent in some districts, particularly in Matabeleland.

IMPORTATIONS.

From the Union of South Africa: Bulls, 122; heifers, 44; horses, 8; donkeys, 16; sheep, 2,074; goats, 335; pigs, 7.

EXPORTATIONS (CATTLE).

To Belgian Congo: Slaughter, 108. To Northern Rhodesia: Slaughter, 36; breeding, 235.

EXPORTATIONS (MISCELLANEOUS).

To Northern Rhodesia: Pigs, 84.

EXPORTATIONS IN COLD STORAGE.

Carcases: Beef, 90; sheep, 25; pigs, 8; veal, 4; livers, 90; tongues, 80; hearts, 340; tails, 90; tripes, 100; kidneys, 50.

May, 1931.

AFRICAN COAST FEVER.

One case occurred on the infected farm Lorelei.

A fresh outbreak occurred on the farm Springfield, part of the Tilbury Estate, and to the end of the month the mortality was 30 head.

FOOT AND MOUTH DISEASE.

Victoria District.—Several outbreaks occurred in the vicinity of the Fort Victoria-Chatsworth Road and one centre of infection was found in the Mtibi Reserve No. 2.

Gwelo District.—Seven fresh outbreaks. An inspection of the centres at which the disease appeared early in April showed that all animals had recovered with very little loss of condition except in one case where the water supply was insufficient.

Charter District.—Twelve fresh outbreaks.

Belingwe District.—In the Shabani section of this district seven outbreaks occurred, the source of infection being the Chibi Reserve in the immediate vicinity.

Gwanda District.—One fresh outbreak.

Generally the disease is of a mild type and the mortality very slight.

ANTHRAX.

One outbreak occurred in Mazoe district, the incontacts were inoculated. Mortality, two.

TRYPANOSOMIASIS.

Several cases reported in Darwin district; two in Hartley; sixteen in Wankie; and cases were diagnosed on six farms in Melsetter district where animals were treated with satisfactory results.

HORSESICKNESS.

One death reported in Insiza district.

MYIASIS (SCREW WORM) IN CATTLE.

A few cases reported from Gwelo and Bulawayo areas.

IMPORTATIONS.

From the Union of South Africa: Bulls, 59; cows, 4; heifers, 2; horses, 14; donkeys, 16; sheep, 1,886; goats, 192.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Notes from the "Gazette."

"Gazette" Date.	*Items.*
	IMPORTED WHEAT.
26.6.31.	It is hereby notified that His Excellency the Governor-in-Council has been pleased to authorise the cancellation of Government Notice No. 709 of 26th October, 1928, and, under the powers conferred by section 16 of the "Customs and Excise Tariff Act, 1926," to approve of a rebate or refund of the Customs duties on wheat imported by a *bona fide* miller or milling company when such wheat is used and blended with wheat grown and produced in this Colony in the process of manufacture of flour or meal: such rebate to be on the basis of the duty on four bags of imported wheat to every bag of Southern Rhodesian wheat purchased and ground into flour or meal in this Colony.
	Such rebate shall be subject to such conditions as the Controller may impose for the purpose of safeguarding the revenue. (G.N. No. 409.)
	AFRICAN COAST FEVER.
26.6.31	Government Notice No. 191 of 1931, declaring areas of infection in the native district of Mazoe is cancelled. (G.N. No. 405.)
	MAIZE CONTROL ACT, 1931.
3.7.31.	The schedule attached to Government Notice No. 356 of 1931 is deleted and a new form of participation certificate is substituted. (G.N. No. 421.)
	FOOT AND MOUTH DISEASE.
3.7.31.	His Excellency the Governor-in-Council has been pleased, under the "Animals Disease Consolidation Ordinance, 1904," notwithstanding anything to the contrary contained in any regulations proclaimed under the said Ordinance, to proclaim the following area under the restrictions provided by Government Notices Nos. 251 and 348 of 1931:—
	Description of Area.
	That portion of the native district of Insiza bounded on the west by the Insiza River, thence by and including the following farms: Fairview, Indutywa, Kogha, Infiningwe, Sampson Block, Reserve, Umunwe, Roodeheuval, Welgevonden and De Beers Block. (G.N. No. 422.)
	AFRICAN COAST FEVER.
3.7.31.	Government Notice No. 298 of 1931 is cancelled and the following declared an area of infection and guard area:—
	NATIVE DISTRICT OF SALISBURY.
	(a) *Area of Infection.*
	The farms Cleveland, Lorelei, Rodia, Green Grove, Green Grove "A" (including Tony Croft), Bingley, Cayan, Doon, Letombo, Amby and Makabusi "A."

(b) *Guard Area.*

(1) An area including the following farms: Donnybrook, Ventersburg, Adelaide, Glenwood, Epworth, H. W. Lot, Widdecomb Park, Good Luck, M.T.C., Greendale south of the Arcturus Road (including Rhodesville) and the Salisbury Commonage.

(2) The Great Bromley Estate. (G.N. No. 431.)

GAME AND FISH PRESERVATION ACT, 1929.

10.7.31. Sections 3 and 6 of the Act are suspended in respect of all varieties of antelope mentioned in Parts "A," "B" and "C" of the first schedule to the Act within the Mzarabani Reserve, Darwin district, until 31st December, 1931. (Proc. No. 28.)

TSETSE FLY ACT, 1929.

10.7.31. Government Notice No. 29 defines an area in the Wankie and Bubi districts as a "tsetse fly area" until further notice. This area is known as the "Gwaai River Tsetse Fly Area."

10.7.31. Government Notice No. 440 contains the regulations which apply to this area.

AGRICULTURAL STATISTICS.

10.7.31. Government Notice No. 432 makes provision for the collection by the Government Statistician of statistics or estimates from growers of tobacco relating to (a) tobacco plantings and crops, (b) the use of artificial and other fertilisers for tobacco, and (c) the number of tobacco barns built (or to be built) and used in respect of the seasons 1930-31 (actual) and 1931-32 (intended).

AFRICAN COAST FEVER.

10.7.31. Government Notice No. 438 is cancelled and the following farms in the native district of Gwanda are released from all quarantine restrictions.

An area bounded by and including the farms Spitzkop, Doelfontein, the fenced-off portion of Thornwood Block, Timber, Sablevale and southern half of Hampden Place which is subdivided into plots. (G.N. No. 438.)

AFRICAN COAST FEVER.

10.7.31. Government Notice No. 318 of 1931 is cancelled. The western section of the farm Wolfscrag and the farm Schaapplaats in the Melsetter native district is declared an area of infection. (G.N. No. 439.)

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 581. Leguminous Crops for Stock and Soil Improvement in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 603. The Production of Maize in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 724. Ploughing by Tractor, by A. W. V. Crawley, M.E., F.G.S.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 750. Cotton in Southern Rhodesia—Hints to Growers, by G. S. Cameron, Empire Cotton Growing Corporation.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld : Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea) : Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 777. Some Aspects of Cost of Production Studies in Agriculture, by Arthur G. Ruston, D.Sc., Department of Agriculture, Leeds University.

No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 783. Agricultural Costings at the Gwebi Farm—Fattening for Beef, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.

No. 794. Some Further Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.
No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
Botanical Specimens for Identification.
Accelerating the Sprouting of Potatoes.
Further Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron, Cotton Specialist.

REPORTS ON CROP EXPERIMENTS.

No. 94. Second Report on Experiments, by J. H. Hampton.
No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
No. 239. Reports on Crop Experiments, Gwebi, 1915-16, Part I., by E. A. Nobbs, Ph.D., B.Sc.
No. 246. Report on Crop Experiments, Gwebi Farm, Season 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
No. 342. Rotation Experiments, 1913-19, by H. G. Mundy, F.L.S., and J. A. T. Walters, B.A.
No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-20.
No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.
No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.
No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.
No. 437. Annual Report of Crop Experiments, Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.
No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 485. Annual Report of Experiments, 1922-23, Agricultural Experiment Station, Salisbury, by J. A. T. Walters, B.A.
No. 486. Bulawayo Experiment Station, Annual Report for Season 1922-23, by H. G. Mundy, F.L.S.
No. 514. Bulawayo Experiment Station Report, 1923-24, by H. G. Mundy, F.L.S.
No. 519. Annual Report of Experiments, 1923-24, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.
No. 537. Crop Rotations on the Gwebi Experiment Farm, 1923-24, by H. G. Mundy, Dip.Agric., F.L.S.

No. 564. A Maize Rotation Experiment, by A. R. Morkel.
No. 566. Bulawayo Experiment Station, Annual Report for Year 1924-25, by H. G. Mundy, Dip.Agric., F.L.S.
No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.
No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.
No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.
No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.
No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.
No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
No. 767. Gwelo Municipal Demonstration Stations. Annual Report for the Season 1928-29, by D. E. McLoughlin.
No. 773. Bulawayo Municipal Demonstration Station: Report for the Seasons 1927-28 and 1928-29, by D. E. McLoughlin, Assistant Agriculturist.
No. 789. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, 1928-29, by H. C. Arnold, Manager.
No. 800. Bulawayo Municipal Experiment Station: Report for the Season 1929-30, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 806. Gwebi Demonstration Farm, by the Chief Agriculturist.
No. 810. Gwelo Municipal Demonstration Station: Annual Report, 1929-30, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

TOBACCO.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
No. 607. Tobacco Seed Beds, by D. D. Brown.
No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.
No. 617. Dark Fire-cured Tobacco, by E. M. Matthews, B.Sc., Tobacco Adviser. Fire-curing Tobacco Barn, by the Tobacco Advisers.
No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
No. 679. Tobacco Culture in Southern Rhodesia: The Harvesting and Curing of Virginia Tobacco, by D. D. Brown.
No. 689. The Lesser Tobacco Wireworms, by Rupert W. Jack, F.E.S.
No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.
No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.

No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.
No. 734. Common Faults in Curing Virginia Bright Tobacco, by D. D. Brown, Tobacco and Cotton Expert.
No. 746. The Development of the Tobacco Industry in Southern Rhodesia. A Historical Survey, by D. D. Brown, Chief Tobacco Expert.
No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
No. 765. Seasonal Notes on Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.
No. 771. Dark Fire-cured Tobacco: Field Operations, by D. D. Brown, Chief Tobacco Expert.
No. 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.
No. 779. Mycological Notes—Further Experiments on the Control of White Mould (Erysiphe Cichoracearum DC.) of Tobacco, 1927-28, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.Sc. (Agr.), Tobacco Adviser.

STATISTICS.

No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
No. 247. Statistical Returns of Crops Grown by Europeans in Southern Rhodesia for the Season 1915-16, by E. A. Nobbs, Ph.D., B.Sc., and Fred Eyles, F.L.S.
No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
No. 361. Statistics of Live Stock and Animal Produce for the Year 1919, by F. Eyles, F.L.S.
No. 380. Statistics of Crops Grown by Europeans in Southern Rhodesia, 1919-20, by H. C. K. Fynn.
No. 393. Statistics of Live Stock and Animal Produce for 1920, by H. C. K. Fynn.
No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1920-21, by H. C. K. Fynn.
No. 426. Statistics of Live Stock and Animal Products for the Year 1921, by H. C. K. Fynn.
No. 484. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1922-23, by A. Borradaile Bell.
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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Melsetter.—The illustration on the opposite page serves as a reminder of the scenic beauties of the Melsetter district, which is becoming very popular with the motoring public and is making a decided appeal as a health resort for the jaded town dweller of the Colony. The charm of Melsetter and the Umtali district in general, with its glorious panoramas, its changing vista of verdant mountain and valley and its invigorating air, is becoming known beyond the confines of Southern Rhodesia and is each year attracting an increasing number of visitors from other parts of Africa and elsewhere, all of whom speak in no unmeasured terms of the beauties they have seen.

The attractions of Melsetter are, however, not merely scenic, for it has agricultural and pastoral possibilities which are as yet hardly developed. The farmers are alive to this

fact, and have taken it upon themselves, through the medium of the Melsetter Farmers' Association and the Melsetter Farmers' Publicity Committee to make Melsetter better known to the world in general. The accumulated knowledge of the residents is set forth in a brochure which has reached us recently, entitled "Mid-Melsetter—The Farmer's Paradise." Commencing with a review of the settlement of the district from those early days when the Moodie Trek, after a long and arduous journey from the south, outspanned their wagons in what is now known as South Melsetter, the brochure passes on to a somewhat detailed description of Mid-Melsetter as a farming centre. Melsetter has, of course, been handicapped by its remoteness from the railway, but the advent of the road motor service has done much to minimise the difficulties of transport. Although several of the statements contained in the brochure might be challenged, on the whole the farming possibilities of the district are moderately expressed and portray fairly reasonably the return which farming has to offer for the investment of capital. In any event the prospective settler would naturally wish to see the country before he committed himself to any purchase of land, and in this way could assess for himself the prospects of farming in this healthful and charming district.

The brochure is well illustrated and can be procured from the secretary of the Farmers' Association, as well as from the High Commissioner for Southern Rhodesia in London.

The Tobacco Position in Great Britain.—"The stage has been reached when the rate of progress is likely to slacken, and the consumption may be stationery, and even recede, unless a deliberate sustained and painstaking effort is made by the growers themselves in combination to arouse interest on the part of manufacturers, not by selling more leaf to present users, but by interesting more manufacturers and by interesting wholesale merchants and retail tobacconists in putting products containing Colonial—and, from our point of view, Rhodesian—leaf before the consuming public." This is the conclusion arrived at by the Honourable J. W. Downie, our High Commissioner in London, after a study of the market conditions for Southern Rhodesia tobacco in Great

Britain. It is contained in a report which we publish elsewhere in this issue of the Journal, and which we trust will receive wide publicity throughout the Colony. It will be seen that Mr. Downie advocates the establishment of an organisation which will study markets, learn buyers' requirements, advise producers and cultivate interest among users of tobacco. He tells us that the need for action is urgent, for "time lost can never be regained." The significance of this admonition is apparent. Tobacco growers and all those interested in the industry must be up and doing and translate into action the lead which Mr. Downie so clearly gives.

Tobacco Statistics.—According to information received by the Government Statistician in response to the notice which appeared in the Press and the *Government Gazette*, the contemplated acreage to be planted with flue-cured tobacco in the ensuing season is 21,333, representing an increase of 8,173 acres over the area planted in 1930-31. The actual outturn of flue-cured tobacco last season was 6,866,371 lbs., and if an average yield is obtained in the season 1931-32, the crop should total 11,597,190 lbs. The number of farmers reporting their intention of growing tobacco in the coming season is 527, compared with 361 in 1930-31, and the average acreage for all prospective growers in 1931-32 is 49½ acres, as compared with 45 acres in 1930-31. Growers report that they intend using 2,809 tobacco barns in 1931-32, which number includes 323 under construction. The bulk of the flue-cured tobacco is produced in the districts of Hartley, Lomagundi, Mazoe, Salisbury and Marandellas, but fair quantities are also grown in Makoni and Mrewa.

The figures received by the Government Statistician indicate a material increase in the acreage to be planted with fire-cured tobacco. The area in 1930-31 was 2,080 acres, but this season the intention is to plant 3,275 acres. The bulk of the increase occurs in the Mazoe district, where an addition of 1,051 acres is indicated. Production of fire-cured tobacco in the season 1930-31 amounted to 1,218,000 lbs., and given a normal yield this coming season, the crop should total 1,859,000 lbs.

The total crop of Turkish tobacco in 1930-31 was returned as 409,000 lbs. from 884 acres; in 1931-32 the declared intention is to plant 1,357 acres, which normally should yield 600,000 lbs. The crop is grown chiefly in the Lomagundi district.

The value to the Colony of the tobacco crop harvested in 1930 and marketed in 1930-31 was, as nearly as can be estimated, £425,000. The average declared value per lb. of unmanufactured leaf tobacco exported in 1930 was 10¾d. per lb.

The data collected by the Government Statistician are being considered by the Government.

Price Levels.—"The average price of 25 of the most important raw commodities is now 32 per cent. below the pre-war level, and has fallen by nearly 50 per cent. since the beginning of the depression." This statement was made by Dr. J. E. Holloway, Director of Census and Statistics, in his presidential address at the annual meeting of the Economic Society of South Africa in Johannesburg and reported in the *Rand Daily Mail*. He examined various statistics of prices in South Africa, Europe and America, and pointed out how the collapse in prices had put a terrific strain on the primary producers. There was a very considerable gap between the fall in prices of raw materials and of manufactures, and the farmer was labouring under a great handicap by having to take low prices for his produce and having to pay relatively high prices for his implements and articles of consumption.

Dr. Holloway examined the prices over a long period of 25 commodities in a raw or slightly-manufactured state, and including metals and minerals, textiles, cereals and certain foodstuffs. He found that there were only three—iron, flax and coffee—the prices of which had not fallen below the pre-war level. All the rest showed a very considerable drop, in some instances to a record low level. The price index of these 25 commodities on the 1914 bases was 1,295 in May, 1928, and 680 in May of this year. If 1,000 was taken as the price index for farm products in 1928, then the present index for South African goods was 794. Hides now stood at 349, skins at 304, maize at 635, wheat at 873 and sugar at 891. In the United

States of America the index for farm products in March, 1931, was 667.

In examining retail prices, Dr. Holloway pointed out that while in the United Kingdom wholesale prices were higher than the pre-war level by only 6 per cent., retail prices were higher by 50 per cent. In South Africa the wholesale prices were 9 per cent. higher than the pre-war level, but the retail prices were 24 per cent. higher.

European Tobacco Consumption in 1930.—According to "Tobacco," the American trade journal, the consumption of tobacco products in Europe in 1930 was approximately equal to that of 1929. From 1926 to 1929 consumption increased at an average rate of 3 per cent. per annum. In the United Kingdom it appears to have increased about 2.5 per cent. in 1930, but in Continental Europe it was one-half of 1 per cent. less than in 1929. The consumption of cigarettes in the United Kingdom appears to have been about 4 per cent. larger than in 1929. In Continental Europe the consumption of cigarettes was almost equal to that of 1929, and the consumption of cigars slightly larger than in 1929; but the consumption of other classes of products declined.

Approximately one and one-half billion lbs. of tobacco, an amount approximately equal to the crop of the United States, was used by manufacturing plants in Europe—outside Russia —in 1930. Almost one-half of this quantity was grown in Europe and the remainder imported largely from the United States, the Dutch East Indies, British colonies and Brazil, between 35 and 40 per cent. of the imports being from the United States.

It is estimated that 40 per cent. of the tobacco consumed in Europe in 1930 consisted of cigarettes. This figure varies from country to country, it being about 70 per cent. in the United Kingdom, only about 16 per cent. in the Netherlands and averaging approximately 36 per cent. in Continental Europe. The cigarettes consumed in the United Kingdom consist almost entirely of flue-cured tobacco imported from the United States, whereas those consumed in Continental Europe consist largely of Oriental tobacco imported from

Greece, Turkey and Bulgaria, except in Yugo-Slavia, Rumania and Italy, in which the major part of the tobacco consumed in cigarettes is grown in the respective countries.

Wheat Farming in the Western Cape Province.—In May, 1930, the Division of Economics and Markets of the Union of South Africa instituted an economic enquiry into the wheat farming in the Western Cape Province, and a report on the first crop-year has now been published as Bulletin No. 103. The report so published is based on data obtained from 44 farms in the Swartland and 39 in the Caledon-Bredasdorp area. In the Swartland the farmers had on an average 44 per cent. of their cultivable land under crops, while 56 per cent. consisted of fallow and old lands. The average size of a farm in the Swartland was 759 morgen, of which 647 morgen comprised land under cultivation, and in Bredasdorp 843 morgen, of which 442 morgen were cultivated. The capital investment in live stock, implements, improvements and land amounted to about £11,300 per farm for each area. In the Swartland the average income per farm was £2,294, and in Bredasdorp £1,593, of which 59 and 54 per cent. respectively represented the proceeds of the sale of wheat.

The average expenditure per farm (interest not included) was £1,574 for the Swartland and £1,039 for Bredasdorp. After deduction of interest on the total capital investment, farmers in the Swartland showed an average profit of £178, while in Bredasdorp a loss of £2 per farm was shown.

The average wheat production in the Swartland was 1,497.8 bags per farm, or 7.69 bags per morgen, and in Bredasdorp 1,028.6 bags per farm, or 8.49 bags per morgen. The total value was £1,529.8 and £981.6 respectively.

Agriculture in Kenya.—The agricultural census for the Colony and Protectorate of Kenya shows that the total acreage under occupation by Europeans as at 31st July, 1930, was 5,111,161, as compared with 5,000,648 acres in the preceding year. Of this total the cultivated area amounted to 643,644 acres, of which 233,973 acres were under maize, 138,012 under

sisal, 96,042 under coffee, and 63,217 acres under wheat. The maize crop yielded 1,858,586 bags, equivalent to an average country yield of 7.94 bags per acre. The number of maize growers (Europeans) in the Colony is returned at 971. The quantity of maize exported from Mombasa during 1929-30 was 1,429,094 cwts., as compared with 912,561 cwts. for the previous year. These figures are inclusive of exports of "native" maize, the crop of which was estimated to yield 1,387,104 bags, representing an average return of 3.59 bags per acre. The total quantity of "clean" coffee produced was 217,114 cwts.

The wheat crop amounted to 293,468 bags of 200 lbs., giving a country average yield of 4.64 bags per acre. There were 398 European growers of wheat in Kenya on the 31st July, 1930. Exports of wheat and wheat flour increased from 161,755 cwts., valued at £99,505, in 1928-29 to 210,269 cwts., valued at £114,946, in 1929-30.

The total value of agricultural commodities exported from Kenya during the year 1929-30 amounted to £2,901,038, representing an increase of £379,050, or 15 per cent., over the previous year. Expressed in tonnage, exports in 1929-30 amounted to 133,925, in 1928-29 to 100,333, and in 1927-28 to 93,430. There were 2,097 European occupiers of land in 1930, and the average value of exports per head was £1,168.

The number of cattle in the possession of Europeans on 31st July, 1930, was 226,861, representing an increase of 8,471 over the total for the previous year. There are now 207,237 wool-bearing sheep owned by Europeans in the Colony.

Population Problems.—Although not an agricultural subject, *per se,* the matter of population density is of some concern to the primary producer here and elsewhere, and it may be of interest to refer to some of the opinions expressed at the second general assembly of the International Union for the Scientific Investigation of Population Problems on the 15th June and reviewed in the issue of "Nature" for 4th July. Professor P. K. Whelpton, of the Scribbs Foundation, said that population increase was declining rapidly in the United

States of America, being 9 per cent. in 1930, as against 18 per cent. in 1920. Consequently, the age composition has changed considerably in the last decade. He showed that the number of children under five years has actually declined, while the number of people over fifty has increased about 25 per cent. This slower growth and trend towards a nation of elders should have a marked effect on economic, social and political life, checking expansion and making for greater conservatism. According to further information given at this assembly, it would appear probable that the population of the United States will become stationery in the course of the next generation or two with a birth-rate of 14.28 per 1,000, and that, having reached this stationery stage, it will then proceed to decline at a rate that will reduce it to one-half in 300 years, in 161 years, in 108 years or in 80 years, according to whether or not certain variable factors operate. According to Professor A. L. Bornley, of the London School of Economics, the falling birth-rate in Great Britain since 1914 has resulted in a decrease in the number of child-bearing women, a fall in the number of children and an increase in the number of old people. With the rise of the real wage and the reduction in the number of children, future generations, it is thought, will live in an environment progressively more and more favourable for satisfactory development. Smaller families mean better housing conditions and less competition for employment.

As regards Belgium, Professor Baudhuin, of the University of Louvain, concludes that the population is now approaching its maximum, which it will attain about 1940, when it will number 8,110,000, and that after then there will be a gradual decline, so that in the year 2,000 it will be only 5,760,000.

Professor Fawcett, who dealt with some factors of population density, estimated that the total habitable land area of the world is about 50,000,000 square miles, and the approximate population of the world about 2,000 million. The mean density of population over all the inhabited land of the world is therefore about 40 persons per square mile. The actual distribution of population over the land varies from 680 per square mile in Belgium to 2.2 in Australia. Professor Fawcett holds that there is no indication that the fertile

regions of the New World are likely to become the home of densely-crowded peasant populations comparable to those of China.

It is apparent that population problems are receiving a good deal of attention, for at the assembly mentioned delegates were present from 10 nationalities. Fourteen countries already have national committees which function with varying intensity, whilst in other countries national committees are in process of organisation.

"Diseases of Tobacco in Southern Rhodesia."—This book has been written by Mr. J. C. Hopkins, Plant Pathologist, for the guidance of local growers in the prevention and control of the numerous diseases to which the tobacco plant is subject. Mr. Hopkins has amplified the material obtained by him in this Colony with data from other sources, and the book will also be found of use to growers outside the boundaries of Southern Rhodesia. In addition to half-tone and line illustrations, coloured plates have been used to depict wild-fire, angular spot, frog-eye, mosaic and red rust, and such excellent results have been obtained in the reproductions that no difficulty should be experienced by anyone in identifying these particular diseases. The book is a very useful addition to the literature which the Department of Agriculture has at the disposal of the farmer and it is expected there will be a ready demand for it. The price is 3s. 6d. post free, and orders accompanied by remittances should be sent to the Accountant, Department of Agriculture, Salisbury.

Report on the Tobacco Position in Great Britain.

By J. W. Downie, C.M.G., High Commissioner for Southern Rhodesia.

The problem of marketing Rhodesian-grown tobacco has been the cause of anxiety to the Government and the growers ever since the big crop of 1927. On my appointment to London, I felt that of the different problems confronting the Government and the Colony tobacco was the most pressing, and accordingly I set myself to get in touch with the leaders in the industry in London and the provinces, and with their aid and the aid of recorded information to make an analysis of the position. A complete analysis is impossible in the time that has been at my disposal; it will take months—bearing in mind my other duties—in fact, the position is an ever-changing one—but I am now at a stage that justifies me in reaching conclusions and in making recommendations. The necessity for action justifies any risk there may be in arriving at conclusions without fuller investigation. I propose to put my conclusions first and to follow on by stating the general position, and in the process I hope the reasons for my conclusions will emerge.

1. An increasing interest in Colonial-grown leaf, and particularly in Rhodesian-grown leaf, is manifesting itself amongst manufacturers in the United Kingdom and Northern Ireland.

2. The stage has been reached when the rate of progress is likely to slacken and the consumption may be stationery, and even recede, unless a deliberate sustained and painstaking effort is made by the growers themselves in combination to arouse interest on the part of manufacturers, not by selling more leaf to present users but by

interesting more manufacturers and by interesting wholesale merchants and retail tobacconists in putting products containing colonial—and, from our point of view, Rhodesian—leaf before the consuming public. In this the Government can help considerably.

3. In so far as Rhodesian leaf is concerned, the presence of Government finance is a deterrent to price improvement.

4. Supplies must be fed to the market in accordance with the demand—the shipping of grades not yet found suitable or acceptable to manufacturers should stop—there must be no attempt at artificial price fixation.

5. There is urgent need for the establishment by the growers, if possible, in conjunction with the Government, of an organisation supported by a levy on all tobacco exported, with functions similar to the New Zealand and Australian Primary Producers' Boards now in London, and acting similarly, studying markets, learning buyers' requirements, advising producers, cultivating interest amongst users and doing general publicity work.

The increased interest in Rhodesian leaf is self-evident. Annexure "A" shows the annual totals in pounds weight of the tobacco removed from bond for consumption. The contrast in the increase of Rhodesian leaf when compared with the total increase for all the Colonies, including Rhodesia, is most marked. The general increase in Colonial leaf is 50 per cent. (approximately). The consumption of Rhodesian leaf is five times as great (1930) as in 1926. In 1928, 42 manufacturers were known to be using Rhodesian leaf. To-day our information shows that there are 72 who claim to use Rhodesian in their smoking mixtures or cigarettes. In 1928 there were 43 brands of cigarettes containing Rhodesian leaf. That number has now increased to 80. In pipe mixtures the comparative figures are: 1928, 131; 1931, 272.

1928.

Manufacturers:		Brands:	
Cigarettes.	Tobacco.	Cigarettes.	Tobacco.
18	24	43	131

1930.

Manufacturers:		Brands:	
Cigarettes.	Tobacco.	Cigarettes.	Tobacco.
28	44	80	272

I am aware that I shall be criticised when I say the progress has been comparatively easy to date—easy in contrast with the progress that is ahead—except in circumstances I shall mention in their place. The need for concerted and combined action can best be seen by a reference to the progressive clearances as shown in Watson's list. In 1925 the percentage of Empire leaf to total clearances was 9.82 per cent., in 1927 it was 14.71 per cent., in 1928 16.62 per cent., in 1929 17.1 per cent. and last year 17.29 per cent. In two years the improvement is only .67 per cent. The whole of that improvement is more than accounted for by the increased consumption of Rhodesian leaf.

The progress to date has been in pipe tobaccos. At a guess 90 per cent. of the Colonial tobacco manufactured in 1930 went into pipe smoking mixtures. It is accepted that all the Indian, practically all the Nyasaland and the major portion of the Canadian, as well as the major portion of Rhodesian, finds its way into pipe mixtures. Canada is the only Empire-producing country likely to compete seriously with Rhodesia in cigarette leaf. Canada has not yet satisfied its own domestic market, and I am informed the growing season is less certain than ours—frost is an ever-present danger.

There are no means of getting reliable figures as to the proportions of tobacco that go to pipe mixtures and to cigarettes. Opinion varies from 80 per cent. cigarette, 20 per cent. pipe and to 70 per cent. cigarette, 30 per cent. pipe. Taking 75 per cent. cigarette and 25 per cent. pipe as a middle figure, the maximum market for pipe-smoking tobaccos is 37-38 million lbs.

There are two possibilities of a more rapid increase in the use of Colonial tobacco: (1) a turnover from cigarette to pipe smoking; (2) a "vogue" for one or more of the many blended American-Rhodesian cigarette at present offered to the public. In so far as stocks are concerned, Watson's list showed 14 million pounds in bond. As a result of investigation, it is estimated that 8 million pounds are in the possession of manufacturers and 6 million pounds stored on account of merchants, dealers, consignors and banks for clients. Of this latter figure (6 millions) approximately 2 million pounds are Northern Rhodesian leaf. Of the remaining 4 million pounds, there is an accumulation of leaf in the medium grades which, leaving

aside price considerations, has not so far found favour with the manufacturers. It is necessary that the market be not loaded further with grades already well represented here. Taken all round, consistent users of Rhodesian leaf are well stocked at low prices; their future purchases are likely to be for replenishment purposes only. They can buy at their own convenience. The great need is to increase the number of manufacturers using Rhodesian leaf rather than to build up long stocks with the principal users. There is persistent enquiry for certain grades of "brights" which appear to have found a permanent place, if available, in the products of certain manufacturers. It is of the utmost importance that growers and growers' organisations see to it that the market is kept supplied with grades in demand. It is only by doing so that the market can be enlarged and more satisfactory prices obtained.

It is opportune to mention here that the market is short of Rhodesian "Turkish" leaf, and manufacturers express the hope that supplies will come forward from the crop now being reaped.

There is a danger that the growers will repeat the mistake of 1926-28 and concentrate all their stocks in one quarter. This should be avoided if at all possible. No one merchant or dealer has the monopoly of supply to all the manufacturers—no one merchant can possibly know the requirements of all the manufacturers—manufacturers themselves, for social or personal reasons, place more confidence in one merchant or dealer than another. The grower's best interest at the present stage in our development is to interest as many dealers and manufacturers as possible.

There are indications that the manufacturers themselves are displaying a keener interest in the source of supply, and the lead given by the Imperial Tobacco Company in buying on the spot is likely to be followed by other manufacturers sending out their own officials to buy for them, or by employing the merchants or dealers to buy for them, or by appointing agents. This procedure should be encouraged by the growers and the Government.

I have stated that the presence of Government finance is a deterrent to price improvement. Trade in the United Kingdom is averse to Government participation or interference—whichever word is preferred. It is not accustomed to Government finance to products; they find it more difficult to reckon the motives that influence Government action than the action of persons or companies formed for purposes of manufacture and for buying and selling. Stocks held to the order of banks and of Governments are tainted, so to speak—they are looked upon as "distress" stocks, and they suffer that fate accordingly. It is for that reason I recommend that the Government encourage a return to finance through institutions existing for trade, and particularly tobacco trade purposes.

Particularly, I recommend that the Government do not finance stocks to this market which are not in demand. The presence of unsaleable grades depresses the value of the grades in demand.

I am strongly of opinion that the interests of the growers will be best served by sending only to this market such grades as manufacturers, merchants and dealers will buy outright, or on which they will make substantial advances—in percentage of value.

There are certain pressing needs. It is necessary that a close study be made of the manufacturers' requirements; there should be a competent person maintaining close contact with users and their varying needs. It is necessary that the growers should have early warning of any *change* in demand, that they should be regularly informed as to the supply and demand position and that they themselves should be able to conform to demand lest supplies flow in from other quarters and displace Rhodesian leaf. It is necessary to create greater interest in Rhodesian leaf. Not only are there manufacturers to consider; there are a large number of wholesale tobacco distributing houses; there are many "multiple" retail establishments; there are two or three hundred thousand retail shops—all these have their organisations—and there is the smoking public.

The primary producers in the Dominions have found it to their advantage to establish representative organisations in this country, supported by a levy on the produce exported.

The best known examples are the New Zealand Meat Producers' Board, the New Zealand Dairy Produce Control Board and the Australian Butter and Australian Wheat Organisations. In addition, there are organisations or representatives attending to the interests of other and less important primary products. New Zealand honey, New Zealand fruit, Australian wine, Canadian apples and South African citrus exchange, and others.

These organisations work in the closest co-operation with their respective Governments. They are in touch with the leaders of their respective industries on the marketing side, they note every change in public taste and favour, they watch the activities of their competitors, they maintain interest in their products, they undertake publicity work in its many phases, they keep their producers informed and render all those services that go to make up what is known as "orderly marketing."

It is very important that the growers in Rhodesia should maintain a supply in this market of those grades of leaf that have already found favour with British manufacturers; there is a danger of certain of the "bright" grades being short of the demand, and should that position arise, users will be compelled to turn to other supplying countries—to the Rhodesian growers' detriment. This is one instance of one of the many users of a growers' organisation. Equally, it is desirable and necessary that where the United Kingdom market is over-supplied with a grade of tobacco, no further supplies should be off-loaded on to the market. Efforts are necessary to interest manufacturers in these particular grades; if those efforts fail, the tobacco should be removed and further supplies prevented from coming here—they can only depress the favoured grades by their presence in the United Kingdom market. Here again is work for the growers' representative. This office, representing the Government, can be of great assistance, but the contact with manufacturers can best be maintained by someone representative of the growers, someone who can speak with authority for them. The growers should know what is wanted; the users should know what is available. Co-ordination is needed.

As instances of the practical work of growers' organisations, the New Zealand Dairy Control, besides providing for staff, spent in 1930 £4,300 on research and £1,500 on exhibitions and in various kinds of advertising and publicity. The New Zealand Meat Organisation spent £1,500 on selling campaigns. Other instances on a smaller scale could be quoted.

I cannot too strongly urge upon the growers and upon the Government the immediate need for co-ordination and sustained efforts in endeavouring to extend the market in the United Kingdom for Rhodesian tobacco. Time lost can never be regained. I am firmly of opinion that every penny provided by the growers for the purposes I have indicated will be returned, and more, in improved returns resulting from extended sales.

The tobacco industry was given the maximum amount of publicity at the Rhodesian exhibit at the Olympia—British Industries Fair; arrangements have been made for the participation in exhibitions, Empire Marketing Board shops, shows, etc., at Plymouth, Birmingham, Cheltenham, Glasgow, Edinburgh, Aldershot, Norwich, Llanelly and London. I hope that as time goes on this form of publicity will be extended.

It only remains for me to add that in my opinion the market for Rhodesian leaf has not by any means been exhausted. The opinion is freely expressed that quality and packing has improved considerably during the last two years. The figures quoted earlier prove that users are taking a greater interest in Rhodesian leaf as leaf; the rate of future progress will depend largely on intelligent and co-ordinated action by the growers—supported by the Government.

Annexure "A."

IMPORTS AND CONSUMPTION OF UN-MANUFACTURED TOBACCO, UNITED KINGDOM, 1930.

IMPORTS.

	Round figures : Lbs.
Total Imports	237,000,000
Foreign—	
U.S.A.	197,700,000
Other	4,000,000
Colonial—	
Rhodesian	3,600,000
British India	13,000,000
Nyasaland	12,800,000
Other (of which Canada approximately 4,000,000)	5,900,000

Note.—Rhodesian imports were 10 per cent. of total Colonial and 1.5 per cent. of grand total imports.

CONSUMPTION (HOME).

	Lbs.
Total Consumption	151,700,000
Foreign	121,900,000
Colonial—	
Rhodesian	5,600,000
Total	29,800,000

Note.—Rhodesian consumption was 19 per cent. of total Colonial and 3.7 per cent. of grand total consumption.

ANALYSIS OF COLONIAL CONSUMPTION BASED ON DELIVERIES FROM LONDON, LIVERPOOL AND GLASGOW.

	Lbs.
Rhodesia	**5,300,000**
British India	**7,800,000**
Nyasaland	**6,700,000**
Canada	**3,400,000**
Others	**1,000,000**

INCREASE PER CENT. OF CONSUMPTION (COLONIAL), 1926-1930.

Year.	Rhodesian consumption (based on deliveries London, Liverpool and Glasgow)	Per cent. increase on consumption of previous year.	All Colonies.	Per cent. increase on consumption of previous year.
1926	1,098,000	—	19,850,000	—
1927	2,000,000	82%	22,800,000	15%
1928	4,095,000	105%	26,600,000	17%
1929	5,067,000	23%	28,600,000	7%
1930	5,322,000	5%	29,800,000	4%

Rhodesia.—1930 figures show an increase of 385 per cent. over 1926.

All Colonies.—1930 figures show an increase of 50 per cent. over 1926.

Note.—The actual total consumption is slightly greater than the amount shown as deliveries, London, Liverpool and Glasgow being in 1930 5,600,000 lbs. (*vide* return from H.M. Customs and Excise).

The Dairy Industry Control Act.

By J. R. Corry, B.Sc., Acting Chief Dairy Officer.

The Dairy Industry Control Act, which was brought into force on the 12th June of this year, is probably one of the most important legislative measures adopted in this Colony within recent years.

This Act, in addition to providing generally for the regulation and control of the dairy industry, also makes provision for the imposition of a levy on all butter and cheese manufactured in the Colony.

As a matter of fact the latter is really the main feature of this Act, and it would probably be advisable, therefore, to discuss briefly the circumstances which necessitated the

adoption of a measure of this kind before proceeding to outline the more general provisions of the Act. It must be understood that in all South African territories, including the Union, Bechuanaland Protectorate, Southern Rhodesia, South-West Africa, etc., dairy production has definitely overtaken consumption, with the result that a considerable surplus of dairy products exists over and above the requirements for local consumption. This surplus must be exported, and at the prices at present obtainable overseas, loss on such export is unavoidable.

In the absence of some scheme by means of which a bounty can be paid on butter and cheese exported, the local price for these products would be reduced to that obtainable for the exportable surplus—at present an exceedingly low figure and one at which the farmer could not be expected to produce.

In appreciation of this state of affairs, legislation has been adopted—or will shortly be adopted—in all of the territories mentioned to provide for the imposition of a levy on all butter and cheese manufactured or imported; the levy funds so obtained will be used to pay a bounty on the surplus dairy produce exported. By this means the loss incurred on export will be spread over the industry as a whole.

All territories participating in this scheme are regarded as one economic unit, and each territory will contribute from its respective levy fund towards the payment of the bounty on the surplus exported.

This arrangement is, of course, essential for the successful operation of the scheme, as no one territory could be expected to export its surplus at a loss and thus stabilise the local market for the benefit of adjoining territories which may not wish to contribute towards the payment of the bounty or share in export levies.

This so-called "Stabilisation Scheme" has actually been in operation for nearly a year, during which period considerable quantities of butter and cheese have been exported overseas. All territories in which the necessary legislation has not yet been passed have been collecting a voluntary levy on dairy produce with which to subsidise export. Had it not been for this levy and bounty scheme, South African markets

would have been flooded with butter and cheese, and butter-fat prices would undoubtedly have dropped to an absurdly low level.

The main object of the Rhodesian Dairy Industry Control Act, therefore, is to enable this Colony to participate in the South African Dairy Stabilisation Scheme. The most important provision of the Act, therefore, is that which provides for the establishment of a Dairy Industry Control Board invested with power to impose a levy, not exceeding 1½d. per lb. on all butter and cheese manufactured or imported into the Colony. From the funds so obtained, which are administered by the Board under the supervision and control of the Minister of Agriculture and Lands, a contribution must be made towards the payment of a bounty on butter and cheese exported from the South African territories previously mentioned; this contribution is paid to the Union Dairy Control Board; the latter actually pays all bounties on such produce as may be exported from the territories participating in the scheme.

The Rhodesian Dairy Industry Control Board, which consists of dairy producers' and dairy manufacturers' representatives, is also invested under the Act with various other powers, amongst which the following are possibly the most important:—

(1) The Board may determine the quantity of butter or cheese which has to be exported from the Colony, and may, furthermore, determine the amount which has to be exported by any particular creamery or cheese factory.

(2) The Board may utilise levy funds, other than that portion thereof required as contribution towards the Union Dairy Control Board, for various purposes, *e.g.*, the funds may be used to encourage the greater consumption of dairy products, or "generally to assist the development or betterment of the dairy industry."

(3) The Board may, with the approval of the Minister, fix a minimum price to be paid for various grades of cream, etc., if it is satisfied that the price paid by the creameries is unduly low in comparison with the price obtainable for butter.

(4) The Board may also publish particulars of prices paid by creameries or cheese factories for butter-fat and milk, and such other information concerning the dairy industry as may be considered necessary.

(5) It shall also be a function of the Board to co-ordinate as far as possible the primary production, manufacture and marketing of dairy produce; and to take such measures as may be necessary to stabilise the prices of dairy produce in the Colony.

In addition to providing for the establishment of a Dairy Control Board, the Act also aims at effecting improvement in methods and conditions of production and manufacture, etc., of dairy products. An important clause is that which provides that "No person shall sell any creamery butter unless the package wherein it is delivered bears on the outside thereof the words 'First Grade,' 'Second Grade' or 'Third Grade,' according to the reputed quality of such butter when placed in the said package."

Provision is also made for the de-grading of creamery butter if the latter on inspection is found to be below the grade indicated on the package containing it.

As far as cheese is concerned, provision is made that after a certain date, all Cheddar cheese will have to be graded and branded according to grade. Cheese may also be de-graded.

Farm butter may not be sold unless the package wherein it is delivered bears on the outside thereof the words "Farm Butter," and the name and address of the producer.

Another important clause is that which requires that all cream shall be graded within three working hours after delivery to a creamery.

Perhaps the most important of the minor provisions of the Act is that which provides for the inspection and registration of all premises on which milk, cream, butter or cheese is produced or manufactured. Under this section all farm dairies on which milk, cream, butter or cheese is produced for purposes of sale, will have to be registered after a certain

date; no premises will be registered unless they comply with such requirements as may be prescribed by regulation.

It will probably be some time before this provision of the Act can be enforced, but the latter should certainly do a great deal towards improving the conditions under which milk and cream are produced in this Colony; improvement in this direction is essential if an export trade in dairy products is to be established and the dairy industry in Southern Rhodesia placed on a sound footing.

Since the above article was written, a Government Notice has been published, in which it is notified that the Dairy Industry Control Board has imposed a levy of 1d. per lb. on *all* butter and cheese manufactured in Southern Rhodesia. The levy takes effect from 1st October, 1931. The method of payment and collection of the levies on creamery butter and on cheese is prescribed in sections 18 and 20 of the Act. The levy on farm butter will be collected in the following manner:—

(a) Bulk supplies of butter wrappers, accompanied by a remittance for an amount equal to as many pence as the number of wrappers to be franked, must be sent by farmers and others to Postmasters at any of the following Post Offices:—Salisbury, Bulawayo, Gwelo, Fort Victoria, Sinoia, Umtali, Rusape, Melsetter, Que Que, Gatooma, Concession, Enkeldoorn, Gwanda and Plumtree.

(b) The Postmaster will issue a receipt for the amount of the remittance and will frank each wrapper with a special rubber stamp indicating that the levy has been paid. A receipt should be obtained for the money paid.

(c) In the event of wrappers being forwarded by post for franking and the consignor desiring that they should be returned by post, it is necessary that a sufficient sum be included in the remittance forwarded to cover such return postage.

(d) The sale after 1st October, 1931, of farm butter in any wrapper which has not been franked is prohibited.

Some Poisonous Plants of Southern Rhodesia.

By SYDNEY M. STENT, Senior Botanist.

Very little research has been carried out on the poisonous plants of Southern Rhodesia. The work of testing a plant to determine whether or not it be toxic, either by feeding tests or by chemical analysis, is an exceedingly lengthy matter, requiring a big staff and specially trained experts and facilities.

If, by feeding an animal with a certain quantity of the suspected plant, it were possible to judge from the immediate results whether it were harmful or not, the process would be comparatively simple; but, unfortunately, this is not the case. Some plants like the "Gifblaar" and "Slang Kop" of the Union show immediate results; some, like "Stiff-sickness" bush (*Crotalaria Burkeana*), only show marked results after continued grazing. *Crotalaria dura*, the "Jachtsickte" plant of the Union, shows no symptoms at all till from two to three months after the animal has been dosed with the plant. Some plants affect one kind of stock only; others are only toxic at a certain stage of growth or under certain conditions. The condition of the animal too affects its susceptibility to certain poisons. There are so many factors to be taken into consideration when carrying out investigations that the testing of plants suspected of poisoning stock becomes a very complicated matter that can only be thoroughly undertaken in a laboratory fully equipped for the purpose with officers experienced in, and able to devote all their time to, this line of research.

We can, however, benefit by the work done in other countries, and especially by that done by the Division of Veterinary Research of the Union of South Africa, where the study of stock poisoning plants has been given every

facility and some very valuable research on this subject carried out.

Much can be gathered about the probable nature and properties of a plant by studying the history of the Family, especially that of its immediate relatives, as shown in the published records of that Family from the various countries in which its members are found. It is fairly safe to assume that if many of the near relatives of a plant have been proved to be poisonous that plant also contains poisonous properties; at least it should be treated as strongly suspected until it has been proved to be harmless.

In order to study the history of a plant or its relatives it is necessary first of all to identify the plant, and farmers are therefore requested to send to the botanist specimens of any plants about which they may have suspicions. The plants must be in flower.

Following is a short account of some of the known or strongly suspected plants of Southern Rhodesia grouped under their Families, with a short description of the chief characteristic of each Family.

OLEANDER FAMILY.

APOCYNACEÆ.

Shrubs, trees or climbers with milky juice. The leaves are usually opposite each other on the branches, the petals of the flowers usually spreading salver-shaped from a narrow tube.

Some of the shrubs bear edible fruits, as the "numnum" and "Amatungula" of the Cape and Natal, but most of the members of this Family are intensely poisonous. Many are used medicinally; the Periwinkle (*Vinca rosea*) is used as a cure for diabetes. The poisonous juice of some of the shrubs has been used by natives as an arrow poison. Rubber is obtained from some species.

Nerium Oleander—**Ceylon Rose**—Oleander.—This beautiful and widely cultivated garden shrub, with its sweet-scented pink or white flowers, is poisonous in all its parts. Cases have been reported where cows have died from being fed under an Oleander bush, some of the leaves having fallen into their food. A case was recorded in the Union where a baby had died from drinking the milk of a cow that

had eaten some Oleander leaves. An old story records how some soldiers in Spain roasted some meat on skewers made from Oleander sticks and all died from the effects of the poisoned meat. Small children should not be allowed to handle the flowers.

Acokanthera venenata—**Bushman's Poison.**—A shrub with milky juice, opposite, shining, rather thick leaves and dense clusters of sweet-smelling, pale-pinkish or white flowers. The fruit is a red or purple "berry."

All parts of this shrub are exceedingly poisonous.

The arrow poison of the Bushmen is said to have consisted of the juice of this tree mixed with latex from a Euphorbia.

This shrub is recorded from Matabeleland.

THE SUNFLOWER FAMILY.
COMPOSITÆ.

The largest group of flowering plants, many of them containing medicinal properties, some of them poisonous to stock. Some of the well-known products of members of this Family are Wormwood, Absinthe, Saffron, Tarragon, Insect Powder (Keating's Powder) and the vegetables Lettuce, Artichokes, Chicory, Salsify.

The Burr-weeds and Thistles, Black Jacks, Burdock and Mexican Marigold are among the weeds of this Family, while species of Sunflower, Zinnia, Chrysanthemum, Aster, Cosmos, Rudbeckia, etc., are commonly cultivated garden flowers.

The Family is very widely distributed, and in all parts of the world poisonous plants have been found among the Compositæ. In the Union of South Africa the following plants of this family have been proved to be poisonous to stock. The vernacular names are those by which the plants are known in the Union:—

Dimorphotheca spectabilis (Bietou). Contains prussic acid.

Dimorphotheca Zeyheri (Bietou). Contains prussic acid.

Geigeria passerinoides (Vermeersiekte bossies).

Geigeria Zeyheri (Vermeersiekte bossies).

Pteronia pallens (Witgat bossie).

Senecio latifolius (Molteno-disease Plant).

Matricaria nigellæfolia (Bovine-staggers Plant).

Senecio latifolius— **Ragwort, Molteno-Disease Plant.**—A very common plant in Southern Rhodesia, with many small yellow flowers in a spreading inflorescence from the top of the plant, and smooth, blue-green leaves that are broader and rounded at the base and spring straight from the stem without any leaf stalk. It produces the disease known as Molteno disease.

Senecio latifolius occurs chiefly on open veld in more or less dry situations, the plants being scattered amongst the veld grasses. Equally poisonous in the dry and green state. Veld containing a quantity of this plant should not be cut for hay.

Geigeria.—There are six or seven species of *Geigeria* recorded from Southern Rhodesia, including *Geigeria passerinoides* and *Geigeria Zeyheri*, that have been proved in the Union to be exceedingly poisonous to stock, more especially to sheep. The other Rhodesian species have not been tested, and should be looked on with suspicion until proved harmless.

The Geigerias have the typical flowers of the Family, like very small sunflowers with a yellow disc surrounded by a fringe of narrow, yellow "petals." Each flower head is without a stalk, and is seated in the forks of the branches or among the usually long and narrow leaves.

THE "GIFBLAAR" OR POISON LEAF FAMILY.

DICHAPETALACEÆ.

A small Family, of which the only member of interest to us is that known in the Union as "Gifblaar" or poison leaf.

Dichapetalum cymosum—**Poison Leaf, "Gifblaar."**—One of the most deadly stock poisons. So far this plant has only been recorded in Southern Rhodesia from Matabeleland, near Bulawayo. It is very common in the sub-tropical areas of the Union, and takes its toll in deaths every year. The Poison Leaf is a low-growing shrub, rarely more than a few inches from the ground, when the leaves first appear.

in early spring. It is generally found in pure stands unmixed with grass or other plants, the vivid green of these "patches" showing up markedly on the otherwise dry, brown veld lure the cattle to their doom. A small quantity of the leaves can prove fatal in a few hours, and death is hastened if the animal drinks water after eating the plant.

HORSE TAIL FAMILY.
EQUISITACEÆ.

A Family closely related to the ferns. The plants have greyish-green, rough, ribbed, leafless, jointed stems, with whorled branches tipped with small cones, within which are the spores or "seed."

Equisetum ramossissimum—**Horsetail or "Dronk Gras."** —The horsetails are found chiefly in moist places, in vleis, on river banks or along irrigation furrows. They are even more poisonous in the dried state than in the green, and care should be taken to see that the plant is not mixed up with hay. The general symptoms of Horsetail poisoning are first staggers (it is called "dronk gras" in the Union), accompanied usually by acute diarrhœa, ultimately paralysis, and death if not treated in time. Young animals are said to be more susceptible to Horsetail poisoning than older ones.

EUPHORBIA FAMILY.

A large group of trees, shrubs and herbs of very different types, usually with a milky juice. The type with succulent roundish or sharply angled stems is fairly common in this Colony, especially among rocks, and the various species are commonly called "cacti," though they bear no relationship with the Cactus Family, only a superficial resemblance. There are leafy trees such as the Mahobohobo that belong to this Family, and small annual herbs such as the various species of Spurge. Some plants of the *Euphorbiacea* yield products of economic value as Tapioca, Rubber, Tung oil, Castor oil, etc. Many contain a virulent acrid poison. The milky juice of some species is so caustic it will harm the flesh; a single drop is often sufficient to raise a blister.

IRIS FAMILY.
IRIDACEÆ.

A large Family related to the Lily Family, with only three stamens and the ovary or capsule below the flower,

not enclosed within it. The *Gladiolus* belongs to this Family, the English Crocus, the Freesias, the Irises and the yellow and purple Tulps of the Union, several of which have been tested and found to be virulent stock poisons.

Moræa sp.—**Tulps.**—Tulp poisoning is known to be the cause of stock deaths in Southern Rhodesia, but little is known about the species of *Moræas* that occur here. There are apparently a number of species with the mauve, iris-like flowers and narrow grass-like leaves, and farmers recognise them all as "Tulps"; but whether all are poisonous or only some of the species has not yet been determined.

LILY FAMILY.

LILIACEÆ.

Plants with tuberous or bulbous roots, usually rather long and narrow leaves and flowers with six "petals," six stamens and a three-celled ovary enclosed in the flower. There are some species of *Liliacea* that are of economic value —the Onion, the Shallot, New Zealand Flax, Asparagus. Many species are cultivated as ornamental plants, and a number are very poisonous. Squills or "rat poison" is made from a species of *Urginea.* In the Union of South Africa two of the most virulent and common stock poisons—Transvaal "Slang Kop" and Natal "Slang Kop"—are members of this Family (*Urginea* sp.).

The beautiful Chinkerinchees or "Stars of Bethlehem" (*Ornithogalum thyrsoides*) is very toxic, especially in the dried state, when mixed with hay and fed to animals.

Gloriosa superba.—This beautiful lily that occurs so plentifully in Southern Rhodesia contains a virulent poison, the roots when eaten are said to produce death in four hours. Fortunately cattle appear to leave these plants severely alone, and we have no record of stock poisoning that has been traced to it. This plant is found growing among grass in the open when it is usually of a straight, upright habit, or in the shade of trees when it becomes a climber reaching towards the light. The bright-coloured flowers, scarlet and yellow to deep purple red, with their reflexed petals, and the oval leaves with their long, narrow tendril-like tips, make it easily recognised.

Bowiea volubilis.—We know of no local name for this plant. It is a climber belonging to the Lily Family. The

long, green, twining stem springs from a bulb, the upper part of which is greenish and shows above the ground. The stem is much branched and quite leafless, and bears numerous green flowers on rather long stalks. The plant contains an irritant poison, and proves fatal to animals if eaten.

Ornithoglossum glaucum.—This has been recorded from Matabeleland. It is common in the sand veld of the Union of South Africa, and is known here as Cape Slangkop. In habit it is rather like a very small *Gloriosa* growing about one foot high, with the much smaller and dark purple or brownish flowers that are reflexed in the same manner; the narrow leaves are not tipped with a tendril.

LEGUME FAMILY.

LEGUMINOSÆ.

The Legume Family is divided into three big sections.

Section I.—*Pappilionaceæ.*—Includes all the Legumes that have flowers resembling those of the pea or bean flower.

Section II.—*Cæsalpineæ.*—Those with flowers of the cassia type.

Section III.—*Miniosoideæ.*—Those with flowers of the mimosa or thorn tree type.

The first section is by far the largest, and includes most of the legumes that are of economic importance—Beans of all kinds, Peas, Vetches, Lucern, Clovers, Pea Nuts, etc. It also includes a number of poisonous plants.

The second section also includes some poisonous plants; and in spite of the fact that many legumes are very valuable fodder plants, it is unsafe for the farmers to feed, to any great extent, any legume he does not know until he has obtained some information about it.

Crotalaria sp.—**Rattle Box Plants.**—There are over thirty indigenous species of *Crotalaria* in Southern Rhodesia, none of which has been tested for poisonous properties. In the Union three different *Crotalarias* have been proved to produce serious stock diseases. In Australia and in America cases of stock poisoning have been traced to *Crotalarias.* It is, therefore, advisable that any members of this group of plants should be regarded with suspicion until they have been proved to be harmless.

The *Crotalarias* belong to the pea flower section of the leguminosæ, and are characterised by having the keel of the flower either sharply bent like an inverted L or curved like an inverted U and by the pods being swollen.

Abrus precatorius L.—**Crab's Eye, Lucky Bean, Jequirity.** —A climber belonging to the pea flower section, with small leaflets and reddish flowers. The conspicuous bright red beans with a black eye are born in small pods densely clustered at the ends of the flower stalks. This plant contains a toxalbumin known as *abrin*, which in action resembles very closely that of the castor oil bean. It is intensely poisonous. The powdered seeds are often used in India in criminal poisoning of cattle, etc., by injecting the powder into the blood; two grams of the powdered seed is sufficient to cause death in forty-eight hours.

Tephrosia vogelii—**Fish Poison.**—A shrub belonging to the pea flower section and plentiful in Southern Rhodesia. It grows to a height of eight to ten feet, and the whole plant, stems, leaves, flowers and pods, are clothed with dense spreading rust-coloured hairs. The flowers, born in rather a dense "spike," are usually purplish and the velvety pods about four inches long.

The plant contains a poisonous principle called *Tephrosin*, and is used to poison fish. Parts of the plant thrown in the water have the effect of stupefying the fish so that they are easily caught, the poison apparently having no deleterious effect on the flesh of the fish.

Dolichos lupiniflorus—**Fish Poison.**—This plant, which belongs to the pea flower section, has a large tuberous root. The flowering stem, which appears first with its "spike" of rather beautiful purplish flowers, is rather like that of a lupin; the leaves which develop a little later are trifoliate. It is used in the same way as the *Tephrosia*, and is common round Salisbury and in other parts of Southern Rhodesia.

Cassia obovata.—A low-growing shrub, sometimes sub-prostrate, belonging to the Cassia section, with short, rather broad and blunt leaflets on either side of the leaf stalk, yellowish-brown flowers and thin, short curved pods. Feeding tests carried out with this plant at Ondersterpoort by the Union Division of Veterinary Research proved it to

be poisonous to stock, but it is very seldom that cases of stock poison have been traced to this plant. Stock probably do not like the plant, and only eat it by accident. It belongs to the group of plants from which the commercial senna is made, and was itself at one time a source of senna, but its collection for this purpose was abandoned in favour of other species. It is recorded from the red soil of Matabeleland, near Matopos.

SOLANUM FAMILY.
SOLANACEÆ.

A large group of plants that includes Tobacco, plants with edible fruits such as the Tomato, Egg Fruit, Cape Gooseberry, the Potato; but at the same time a number of exceedingly poisonous plants such as Deadly Nightshade, Bitter Apple, Apple of Sodom, Belladonna, Stink-blaar or Thorn Apple, Mandrake, etc. Practically every member of this Family contains a poisonous principle in a greater or lesser degree; even the common and universally cultivated potato can become poisonous under certain conditions.

Datura stramonium—**"Stink-blaar," Stramonium.**—A native of tropical America, which has been introduced and become naturalised in this Colony. It is exceedingly poisonous, especially the seeds, both to man and beast. It is a common weed in cultivated ground, and especially in corn fields. Cases have occurred where this plant has been reaped, threshed and ground with wheat, and the flour made into bread, etc., has caused sickness and even death in whole communities. The plant is used medicinally. It contains the active principles *hyoscyamin, atropin* and *scopalamin.*

Solanum sp.—**Apple of Sodom.**—A velvety, hairy plant with mauve flowers and yellow berries usually one inch or more in diameter. It is sparsely spiny all over. There are a number of species of *Solanum* that occur in Rhodesia, many of them very spiny and with the yellow, red or black berries of different sizes. All are more or less poisonous.

Nicandra physaloides—**Apple of Peru.**—An introduced weed from South America. This plant is recorded among the poisonous plants, but no definite case of poisoning has been traced to it. It is a common weed in old or culticated lands, and often if left will grow to a height of six feet or more. It has smooth, green, lobed leaves, blue flowers

and a pod rather resembling that of a Cape gooseberry, but sharply angled.

Solanum nigrum—**Black Nightshade.**—The small black fruits of this plant are often gathered and made into jam and are even eaten raw; but cases have occurred where children have died from the effect of eating these berries. The poisonous principle is said to be present in such small quantities in the *quite ripe* seed that they may be eaten with impunity, but in green or half ripe berries there is sufficient poison to cause illness and possibly death. It is advisable to cut out this plant as an article of diet.

FAMILY.
ZYGOPHYLLACEÆ.

A small Family of low-growing shrubs or herbs, of which two species have been proved in the Union to be poisonous to stock—a species of Zygophyllum and the "Duiveltjes" (*Tribulus terristris*).

Tribulus terristris—**Devil's Thorn, "Duiveltjes."**—A prostrate, greyish-green plant that spreads along the ground, with small leaflets, tiny yellow flowers and irregularly spiny fruits. This plant, eaten under certain conditions, is the cause of the disease known in the Union as "geel dikkop" in sheep. It is recorded from Matabeleland.

Note by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Government Plant Pathologist.

THREE POISONOUS FUNGI.

Diplodia zeæ—**Diplodia (Dry Rot of Maize).**—This widely distributed fungus, about which so much discussion has taken place during the past two years, is the cause of a well-known disease among cattle that are allowed to feed in maize lands which have been reaped. The fungus attacks the maize plant, causing mouldiness in the cob and infection of the stalk. Cattle and sheep which feed upon diseased grain develop a disease characterised by twitchings of flanks and shoulders and arching of back, followed by paralysis and eventual death if a sufficient quantity of the tainted food is eaten. Severe losses from Diplodia poisoning have been

reported from time to time during the past twenty years from this Colony and the Union.

In order to avoid the disease, reapers should be instructed to bring in all cobs and not throw away in the lands those showing mouldiness. Diseased cobs should then be burnt.

Claviceps paspali—**Ergot of Paspalum.**—The well-known ergot of grasses and cereals is caused by fungi of the genus *Claviceps*, which gain entrance to the plants when spores alight upon the floral parts. The germinating spore enters the pistil of the flower and sends out branching threads in all directions, which soon produce further masses of spores accompanied by a sticky substance known as "honey-dew." Insects attracted by the "honey-dew" and animals grazing the pasture carry the disease from plant to plant by means of this sticky substance, containing numbers of spores, which adheres to their legs. Later in the year the fungus grows into a compacted mass; the ergot, which is dark in colour and very resistant to adverse weather conditions, is dropped from the flower and spends the winter on the ground. With the advent of the rains the ergot, or *sclerotium* as it is called, germinates and produces more spores which infect the *Paspalum* as it comes into flower. Thus the life cycle is completed.

The symptoms of ergotism vary, and range from slight inco-ordination of movements to complete paralysis.

The only methods which have been recommended to avoid the disease are aimed at the prevention of flower formation (and hence infection) in the grass. Heavy stocking of pastures early in the season and constant mowing have proved satisfactory.

Erysiphe graminis—**Mildew of Grasses.**—This fungus has been noted so far in Rhodesia only on barley; it probably occurs, however, on other grasses. It may easily be recognised by its appearance as a white powdery coating on the leaves, particularly the lower ones, of affected plants. It is closely allied to the well-known white mould of tobacco and mildews of cucumbers, melons, etc.

The fungus is reported as imparting poisonous properties to hay in which it is included.

Tobacco Growing in Southern Rhodesia.

(Concluded.)

SEED-BEDS.

By D. D. Brown, Chief Tobacco and Cotton Expert.

Sowing the Tobacco Seed.—The sowing of seed too thickly is a mistake commonly made. The following figures indicate the numbers of seeds in relation to any given weight, and may help to prevent growers continuing to make this mistake. Contained in one ounce there are approximately 300,000 seeds, and roughly 25,000 seeds are held by an ordinary teaspoon when filled level with clean tobacco seed. When shelled from the seed-pods, tobacco seed contains a high percentage of inferior seeds, besides a certain amount of dust and chaff. Before tobacco seed is sown, it should be cleaned in a tobacco-seed separator. This machine eliminates the trash and light seeds. Practical and experimental results have definitely proved that tobacco produced from heavy, well-developed seed is more uniform in size and colour, and produces larger yields than crops grown from ungraded seed.

Each individual grower cannot be expected to provide the necessary equipment for seed grading. The Department of Agriculture has hitherto provided the apparatus and done all the work in connection with the cleaning of tobacco seed. This season, however, the work has been undertaken by several firms of chemists in Salisbury and other centres. Growers are therefore advised to make arrangements with any one of these local firms and have their tobacco seed graded prior to sowing.

When using only properly graded seed, the following are the quantities to be used:—

1 oz. of seed is sufficient to sow 120 square yards.

12 ordinary teaspoons (level full) will sow 120 square yards.

1 ordinary teaspoon (level full) will sow 10 square yards of seed-bed.

Lighter applications of seed than at the above-mentioned rate of seeding, are capable of yielding satisfactory results, but can only be recommended in the case of experienced tobacco growers having suitable facilities and using thoroughly reliable seed. Under favourable circumstances the rate of sowing may be reduced by one half, *i.e.*, 1 ounce of seed per 240 square yards instead of an ounce of seed to 120 square yards of seed-bed area.

The tobacco seed is very tiny, and the small quantity necessary for a given area of seed-bed surface renders an even distribution impossible, unless the seed is mixed with some distributing medium.

It has been found from practical experience that wood ash and mealie meal are the most satisfactory materials to use as distributing mediums. They are white in colour, and indicate plainly the distribution of the seed within the medium itself, besides the distribution over the surface of the seed-bed. The proportion for mixing seed and distributing medium is one teaspoon of tobacco seed to about one quart of wood ash or mealie meal. Before sowing, the seed should be mixed thoroughly with the wood ash or mealie meal. Some growers put the tobacco seed into a can of water, and after thorough stirring apply the mixture of seed and water to the beds. This method of seeding the beds is not in general use in this Colony.

In sowing the beds, care should be taken to distribute the seed evenly over the whole surface of the seed-bed. Sowing is best done when the air is calm. Should it be necessary to sow seed-beds when a wind is blowing, much wastage of seed is prevented and more even seeding made possible by holding up a reed mat or similar contrivance on the windward side of the bed. This improvised wind-

break can be moved along so as to enable the person sowing the seed to do so within the shelter so provided.

After sowing, the surface of the bed requires to be lightly beaten with a suitable flat implement, in order gently to firm the seed into the soil. Immediately after this the beds must be watered with watering cans fitted with a finely perforated "rose."

In the early stages of growth especially, the plants require to be kept moist, but not too wet. Usually the newly sown beds are given a watering in the mornings only, and later on, when the seedlings are bigger, a watering morning and evening, while at a further stage in the growth of the plants an additional watering at mid-day may be required. Owing to varying conditions, it is impossible to state how many times a day watering is necessary or the rate of application. A good rule to follow is to have the beds always moist, but not too wet. Before applying water to the beds, the coverings must be removed and replaced afterwards. Watering must be done by cans; irrigation and flooding are not advisable. All the seed-beds should not be sown on the same date, but should be seeded at intervals of about fourteen days.

For Virginia tobacco sufficient seed-beds should be seeded at one time to provide plants for about 20 acres. This will ensure a sufficient area being transplanted to provide enough ripe, uniform leaf for the first curings. When beds are sown at such intervals, the several operations of cultivation and harvesting can be carried out in succession, thus enabling the grower to use his native labour to better advantage.

The area of seed-beds required depends upon the extent of the intended acreage and the type of tobacco grown. For Virginia varieties, about 20 square yards will provide sufficient plants for one acre. For Turkish varieties, 100 square yards are required for each acre to be planted.

Covering.—In the early stages of growth, tobacco plants are very tender and delicate. Extreme cold at night and hot sun during the day are both injurious; some covering is therefore essential to protect the young seedlings from the extremes of heat and cold. Either grass or cheese-

cloth is used for this purpose; growers are, however, advised to use cheese-cloth in preference to grass, as the latter is difficult to manipulate in order to give the seedlings the required amount of sunlight.

If the grass covering is too thick, the plants are inclined to become lanky and weak. On the other hand, should the grass covering be too thin, the young seedlings are often killed through the surface soil becoming too dry. Grass coverings also often harbour the moths of the tobacco splitworm and stalk-borer, both of which pests cause severe damage to the young plants. On the other hand, cheese-cloth protects the plants from the direct rays of the sun and at the same time allows sufficient light to penetrate for the proper growth of the seedlings. If the beds are properly enclosed, cheese-cloth will keep the beds warm at night by retarding radiation. Its use will also protect the plants from insect pests. Cheese-cloth is not an expensive commodity, and with reasonable care can be used for covering beds for a number of successive seasons. If possible, growers are advised to use this material in preference to any other covering for seed-beds.

The cheese-cloth is usually held in place by putting weights (generally bricks or stones) on it at intervals along the sides of the bed. A satisfactory method is to stretch a wire down the outside of one side of the bed, fastening it in a similar fashion to the wire down the centre of the bed, and stitching an edge of the cheese-cloth to it. The other edge of the material is held in place by weights placed upon it at intervals on the top of the side of the seed-bed. When it is necessary to uncover the beds, these weights are removed and the covering folded back until it can be placed near the wire holding down the other edge of the cheese-cloth.

More detailed information concerning the subject of diseases of tobacco is available in the articles published by J. C. F. Hopkins, Plant Pathologist, in the *Rhodesia Agricultural Journal*, available in bulletin form.

Care of Seed-Beds.—**Constant care must be given the seed-beds if satisfactory results are to be obtained. If the seed-beds suffer from neglect, the plants may be destroyed**

by insects or disease; if not properly watered for a few days, the beds may become too dry and the plants receive a bad set-back or even die off.

During the germination period and the early stages of growth, the watering-cans should be fitted with a finely perforated "rose," so that the seed may not be displaced or the soil washed away from the small seedlings. When the plants have leaves about the size of a shilling coin, a more coarsely perforated "rose" should be used on the watering-can. After the plants are larger and firmly rooted in the soil, the use of a "rose" can be dispensed with. For watering plants in this stage, a small square of tin may be clipped to the water-can spout and bent up in such a fashion as to cause the water to fall on to the beds in a broad, flat spray.

At first the cheese-cloth must remain over the beds the whole time except for the short period the beds must be exposed for watering. When the plants have grown a little, the covering is left off for a short period each morning to allow them more sunlight and prevent weak stems. The period of exposure is gradually lengthened as the plants grow, so that by the time they are the correct size for transplanting the covers are left off all day and only replaced at night. This procedure will harden off the plants and enable them to stand being transplanted.

After the plants are large enough for transplanting (roughly six inches high), they should receive only sufficient water to prevent their wilting badly. Should weeds or grass appear at any time, they should be removed from the seedbeds.

Before removing seedlings for transplanting, the seedbeds should be well watered in order that the plants may be removed without damage to themselves or the plants remaining in the bed. After all the suitable plants have been removed, the seed-beds should be again watered so as to firm the soil round the roots of the remaining seedlings.

The plants in the seed-beds may sometimes fail to make satisfactory progress; this may be due to insect pests, diseases or unsatisfactory soil conditions. Very often the soil is water-logged, and drainage should be provided immedi-

ately. Over-crowded beds do not allow the plants to make sufficient growth; when this occurs, thinning out is necessary.

Should insect pests be troublesome, the grower is advised to study the article which appeared in the *Rhodesia Agricultural Journal* of January, 1928, reprinted as Bulletin No. 665, in which the subject of tobacco pests and remedial measures is discussed fully by the Chief Entomologist.

In the case of the lack of plant food, the plants will usually have a sickly, yellow appearance; this is especially noticeable when there is a deficiency of nitrogen.

Nitrogen may be supplied by means of a solution of nitrate of soda or liquid fowl manure. The latter is to be preferred, as it is cheaper and more easily procured, besides also furnishing a more complete plant food than the nitrate of soda. The nitrate of soda solution is:—

1 lb. of nitrate of soda.
8 gallons of water.

The above should be applied to about 20 square yards of seed-bed surface.

The liquid fowl manure is prepared in the following manner:—Take a suitable receptacle and half fill it with fowl manure; to this add sufficient water to fill the receptacle. The receptacle should be allowed to stand for about five or six days, and its contents frequently stirred at regular intervals. After standing for this period, the liquid manure is ready for use. One gallon of liquid fowl manure is diluted in eight gallons of water; this should be applied to ten square yards. A second application of liquid fowl manure may be given a few days after the first application.

The usual tobacco fertiliser of good quality can be used for stimulating the growth of backward seedlings. This is usually applied broadcast over the beds at a rate of one pound to ten square yards.

Immediately after the application of any of the foregoing, the beds should be watered to wash the solutions or fertilisers from the plants and prevent the leaves of the seedlings being burned. When possible, application should be

made on a dull, cloudy day, so as to reduce the danger of the leaves being scorched.

None of the above should be applied to young seedlings with leaves smaller than a threepence coin, as the small plants would be damaged by the solution or fertilisers.

Summary.—

1. Treat every item in connection with seed-beds seriously.
2. Use discretion in the selection of the seed-bed area, and pick the best available site.
3. Make sure that the site is close to a permanent supply of water, sufficient for all requirements right up to the time the seedlings are removed from the seed-bed.
4. Provide suitable drainage for seed-beds.
5. Make the beds and pathways a convenient width.
6. Prepare the beds thoroughly before seeding; they cannot be prepared afterwards.
7. Sterilise the soil in the beds.
8. If possible, use a fresh lot of seed-beds each season.
9. Use the correct quantity of seed in sowing; thickly seeded beds usually mean poor plants.
10. Use good seed, which is properly cleaned, graded and treated.
11. Sow the beds at proper intervals, to give a good succession of suitable plants for transplanting.
12. Erect suitable artificial shelters where necessary round the seed-bed site.
13. Water the beds so that they are kept moist, but not wet.
14. Use a suitable covering for the seed-beds—cheese-cloth for preference.
15. Do not water the beds without first removing the covering; it is otherwise impossible to apply water evenly over the surface of the seed-bed.
16. Keep the seed-beds free from weeds and grass; they rob the plants of food and moisture.
17. Keep the immediate surroundings of the seed-beds clear of all undergrowth and trash; this helps to keep down insect pests.

18. Always soak the beds before removing seedlings for transplanting, and water again immediately afterwards.
19. Have plants the correct size for transplanting (about six inches); long, lanky plants and those less than six inches are not likely to give the best results.
20. Never make seed-beds on soil previously used for growing potatoes; there is a danger of the tobacco plants being attacked by nematode or root gall worm.
21. Use only fertiliser of good quality for application to beds.
22. When transplanting is completed, do not leave the plants growing in the seed-beds, but dig them over.
23. When cheese-cloth is no longer required for covering the seed-beds, remove it, and after being washed and dried roll it up and store safely until required for use next season.
24. Make every effort to have good, strong, healthy seedlings; good crops are seldom produced from inferior plants.

[NOTE.—*An article by the Plant Pathologist on "Care of Tobacco Seed-beds" will appear in next month's Journal.* —Ed.]

Foot and Mouth Disease.

Gwanda District.—In addition to extensions of infection on Liebigs Ranch, two fresh outbreaks occurred—viz., one on the west bank of the Bubye River and one on the west bank of the Umzingwane River. In connection with the latter it has been decided to clear a belt of cattle from the Umzingwane River to the Tuli River near the junction of the latter with the Shashi River.

Chibi District.—There is now no evidence of infection in this district.

Victoria District.—There was a considerable spread of infection in the Mashaba section between the Mshandige and Tokwe Rivers, and also in the Victoria Reserve. In the Zimutu Reserve and the Crown Lands adjoining there has been no further spread of infection.

Ndanga.—The isolated outbreak which occurred in June at Dandazi on the Lundi River has now cleared up. There has been no spread of infection from this centre.

Chilimanzi District.—Three fresh outbreaks.

Charter District.—Two fresh outbreaks.

Gwelo District.—Two fresh outbreaks. With the exception of some oxen belonging to the Municipality, the herds on the Gwelo Commonage appeared to be free from infection at the end of the month.

Belingwe District.—Infection still exists in the southern and western sections of the Lundi Reserve.

Bubi District.—Several outbreaks occurred in this district, and there is no doubt that infection had existed for some time in a very mild form. The nearest known infection to these fresh outbreaks was about sixty miles distant, and this in the first instance in which the dissemination of infection could not be attributed to direct contact by cattle.

Salisbury and Mazoe Districts.—As the result of a movement of cattle from Lochard Siding before the discovery of infection in Bubi district, the disease was carried to the farm Teneriffe, adjoining Mount Hampden Siding, in the Salisbury district. The animals concerned were exposed at a cattle sale and the sale was completed, and various lots of animals moved therefrom before information of the outbreak in Bubi district was available. As a result, the disease broke out at three centres in the Salisbury district, including the Salisbury Commonage, and at five centres in the Mazoe district.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

22nd August, 1931.

Vegetable Growing in Southern Rhodesia.

ASPARAGUS CULTURE.

By G. W. Marshall, Horticulturist.

Before proceeding with this article, it may not be amiss to comment on the very small supplies of asparagus which come forward for sale in Southern Rhodesia. This is difficult to understand, since the crop may be grown with such ease, provided the grower is acquainted with the proper cultural practices. The existence of an up-to-date co-operative marketing scheme for fruit and vegetables in our largest towns should enable producers of high quality, well graded asparagus to dispose of their crops without difficulty and at remunerative prices.

Description of Plant.—There are about 120 species of the genus Asparagus, but although the shoots of a few other specimens are edible, *Asparagus officinalis* is the only one that has found a prominent place in the vegetable garden. The plants grow to a height of from three to six feet, with a fine delicate foliage, which renders them valuable for decorative purposes.

The asparagus root or crown is perennial, making an annual growth of one to three inches. This extension is practically horizontal, although the crown itself rises nearer the surface of the ground each succeeding year. The horizontal roots are fleshy—⅛ to ¼ inch in diameter and light in colour. Small feeding rootlets become hollow and die and are replaced by new roots.

Asparagus is possibly the most valuable perennial vegetable that is grown; it is both palatable and healthful, and

may be utilised either fresh or canned. An added value is that it is available in the early spring when other vegetables are scarce.

Climatic and Soil Requirements.—A number of species of wild asparagus are to be found in Southern Rhodesia, and the climate has proved itself admirably adapted to the requirements of the cultivated species. Many types of soil are suitable, but deep, loose, sandy loams are best. Asparagus plants have extensive root systems, and open porous soils permit of maximum root development, enabling the plants to store reserve food for early spring growth. The earliest crops are harvested from soils that warm up quickly in spring. For normal development, asparagus must have intervals of dormancy. The plants become less vigorous and the shoots spindly if forced to be ever-growing.

Varieties.—No local data are available in regard to the varieties best suited to Southern Rhodesia. "Connovers Collosal" and "Argenteuii" have in the past given satisfactory results, and as they are the favoured varieties, have received most attention. The rapid strides made in the improvement of varieties in asparagus-growing countries, by selection and pedigree breeding, compel one to suggest that the rust-resisting and superior-yielding varieties, such as the "Mary and Martha Washington," recently raised in the United States of America, should be tried in this Colony.

Raising Plants from Seed.—For small plantings, it is advisable to purchase crowns from a reliable nurseryman, but with large plantings it is more economical to raise one's own plants. Furthermore, by adopting this practice, the best seed may be purchased and less root injury will occur when the crowns are to be transplanted. Good seed is the first essential to successful asparagus culture, and without it indifferent results may be expected.

The soil in which the crowns are to be raised must be well worked and brought into good physical condition. The seed should be sown thinly, 1 to 1½ inches deep, in rows two feet apart. The best crowns are produced from seedlings spaced from three to four inches apart. After the seed is sown and covered, the rows should be watered as often as necessary, usually every afternoon.

The best temperature for seed germination is between 75° and 85° F., and the most suitable seeding date in this Colony is during August and September. Seed requires from four to six weeks to germinate, but may be hastened by soaking in water with a temperature of 90° F. for four or five days. Soaked seed should be dried off for a few hours and then planted at once; given good treatment, the crowns should be fit to lift and plant in their permanent beds by the following July.

Preparation of Beds.—Asparagus occupies land for many years, and the soil should be made very suitable and fertile before planting. It should be particularly well supplied with humus, which is often of more importance than the application of commercial fertilizers. This applies particularly to soils of mineral origin; those well supplied with organic matter may need only one or more of the plant food elements to bring them to a good state of fertility. Well-rotted kraal or farm manure is the best fertilizing material to apply; it both improves the physical condition and supplies the necessary plant food. If animal manure is unprocurable, it will be advisable to apply any decayed vegetable matter that may be available, or to plant green crops for digging under. These applications of organic-forming materials should be ploughed or dug into the soil the season preceding the planting of the asparagus crowns.

Many of our Southern Rhodesian soils will require an application of commercial fertilizer in addition to the manurial treatment indicated. Investigations in California recommend an application of 1,000 to 1,500 lbs. of fertilizer per acre, containing 4 per cent. to 5 per cent. of nitrogen, 8 per cent. to 10 per cent. phosphoric oxide and 6 per cent. to 10 per cent. of potash. This application represents approximately 1 to 1½ lbs. of fertilizer to five square yards of asparagus bed. The application may be made either before or after the crowns are set.

All asparagus soils must be well worked so as thoroughly to incorporate the added manure, organic matter and fertilizer. They should be brought into the best possible condition by several deep ploughings or by trenching.

Establishing the Beds.—One year old crowns are the most desirable for planting, and care must be exercised that

only the best and least injured plants are set. Small and inferior crowns will never produce good shoots, and should be discarded.

When the beds have been thoroughly well prepared, furrows should be opened deeply and the crowns set in loose soil at a depth of 6 to 8 inches; in heavier soils at 4 to 6 inches. The crowns should be planted from 18 to 24 inches apart in the rows; from 3 to 4 feet apart between the rows; the wider espacement being for white (canning) asparagus, since it permits of soil being taken from between the rows to form ridges over the crowns. In setting the crowns, the roots should be spread in a natural position. A small mound of earth is made in the bottom of the furrow, and the crown is set on the peak of this, after which it is covered with 2 or 3 inches of soil; then add more as the shoots develop, until the crowns are at the correct depth.

Fertilizing.—Mention has already been made to the application of fertilizer when preparing the beds and the treatment then given must not be confused with later applications. Asparagus should be fertilized every year; the character of these applications will depend upon many factors, and growers must be guided by the growth and yield of the plants. Application of manure or fertilizer subsequent to the setting of the crowns should be made after harvesting ceases; the plants then draw heavily on plant food for storage in their fleshy roots. Nitrate of soda is often used as a top dressing on asparagus fields that are inclined to go off. These applications may be made during the cutting season, and should not exceed 1 pound to 25 square yards of bed. The approximate *annual* application of manure and fertilizer for asparagus beds is 10 tons and 1,000 lbs. per acre respectively, but these quantities may be increased or decreased as considered desirable. The fertilizer should contain approximately the same plant food elements as previously stated.

Irrigation.—Owing to the lengthy dry season experienced in Southern Rhodesia, it will normally be necessary to water or irrigate asparagus from early August to the commencement of the rainy season. The water should be led between two rows and allowed to run for several hours to enable it to penetrate to a good depth. The frequency of

application and the amount to apply depends on many factors, but as a basis to work on, it is suggested that water be applied every fortnight at the rate of, approximately, 50,000 gallons per acre.

Cultivation and General Management.—Cultivation must be frequent to keep down weeds, but should be shallow; otherwise serious root injury will result. Hand hoeing may be necessary after the first season to kill stray weeds near the plants. As the crowns grow older they come nearer to the surface, and it becomes necessary to raise the beds or ridges. At the end of the cutting season, all ridges may be levelled and flat culture practised, but care must be taken that the crowns are not damaged. Fertilizers may be worked in with this cultivation. The above-ground growth of asparagus should not be removed until it has dried off, for if treated otherwise, there is grave danger of reducing the subsequent crop through the inability of the plant to store sufficient reserve food for early spring growth. After the removal of the tops, the beds or flattened ridges may be liberally mulched with well-rotted manure or decayed vegetable matter. This practice is very desirable; it protects the crowns from adverse climatic conditions occurring during the dormant period, and the mulch will gradually become incorporated in the soil with subsequent cultivations, thereby increasing the humus content of the soil. Low growing crops, such as beans, lettuce and others, may be inter-planted between the asparagus rows. This practice will furnish a small return, but is only advised where it cannot be avoided.

The harvesting of asparagus is often delayed until the crowns are three years old, but this is not necessary with well-grown plants, which may be harvested for a short period during the second season. The best spears may be cut for two or three weeks the year after planting, as early cutting does not appear to weaken the plants unduly. Early cutting tends to enlarge the crowns. The second season's cutting may be extended to five or six weeks, and subsequent cuttings up to eighteen weeks, or even more. Weak and spindly spears are an indication of over-cutting or exhaustion of the roots, due to want of plant food or other unfavourable conditions.

With proper care, asparagus may remain profitable for ten years or more. Peak production may be expected in the fourth or fifth years; the productive life depends upon the climate and soil fertility. Temperate climates encourage crowns that live to the greatest age. The climate of Southern Rhodesia is rather warm, and the profitable life of asparagus is thereby diminished, but the spears develop more rapidly here than in colder climates.

When cutting commences, it should be at least twice a week; later, as the season advances, it may be daily, or even twice a day. Asparagus is usually cut with a knife made specially for the purpose. The knife should be placed near the shoot to be cut, passed straight down for 6 to 8 inches into the soil and then tilted to make the cut. Cuts must not be made too near the crown. Spears should, on no account, be cut above the ground.

Marketing.—Asparagus soon loses its edible quality, and it is advisable to harvest, bunch and market it as soon as possible. It is stated that high temperatures cause loss of sugars and increase fibre, and that the most rapid changes occur within the first twelve hours. All spears should be protected from the sun while harvesting, and if they are to be kept for some time they should be stood in water in a cool place. Spears must be graded to size and tied into one pound bundles—two ties are best. The bundles should be from 6 to 8 inches in length, with the butts squared off with a sharp knife.

White asparagus should be washed and drained with the butts down before it is tied. It may then be wrapped in parchment paper, leaving only the buds or tips exposed. In most asparagus-growing countries, the grades range from a quarter of an inch (very small) to three-quarters of an inch and over (large).

Asparagus should be packed in small containers to hold 24 one or 12 two pound bundles. The boxes should be lined with paper, and damp moss should be placed on the bottom on which butt ends of the asparagus should rest.

The Potato

(Solanum tuberosum.)

(Continued.)

METHODS OF CULTIVATION IN SOUTHERN RHODESIA.

By S. D. Timson, M.C., Dip.Agric. (Wye),
Assistant Agriculturist.

"Seed Potatoes."—The question of his "seed" supply is the most important one which faces the grower of potatoes, and one on which the whole success of his enterprise depends. The problem of securing the supply of seed best suited to each grower's particular needs is a most complex one and involves the consideration of a number of factors, all of which may have a profound effect on the yield of the resulting crop. The most important of these factors are dealt with briefly below.

Storing and Sprouting.—The use of sprouted tubers for "seed" is universally accepted throughout the world as being necessary to obtain the best results, and the practice offers the following advantages—(1) higher yields per acre are obtained; (2) earlier maturity of the crop is assured; (3) a more even growth and a better stand of plants in the field is obtained; (4) virus disease is checked, since those tubers having weak spindly sprouts, or showing other symptoms of the presence of virus disease are eliminated.

Great difficulty has been experienced in the past in finding a method of storage of "seed" tubers which will assure their being brought to the field in a satisfactory state for planting, owing to the early sprouting and rapid exhaustion of the tubers induced by the high temperatures of the

early spring months. This difficulty has been particularly pronounced in the case of "early" and "mid-season" varieties, which have been imported and tested in the past, and has led to their being discarded.

Within the past few years, however, the Division of Plant Industry has worked out a simple and satisfactory solution, which is described in the *Rhodesia Agricultural Journal* of April, 1928, "Notes on Farm Practice at the Government Farm, Gwebi," and reprinted as Bulletin No. 685. This consists essentially in the storage of the "seed" tubers on wire-netting shelves, under a light cover of grass thatched roof and walls to protect the tubers from sun and frost. As soon as the tubers commence to sprout, the grass cover is gradually thinned out to allow the entry of more light and air, so that the young shoots are checked in growth and become thickened and "greened." This type of shoot, induced by proper methods, possesses many more nodes than the thin, yellow shoots formed in the absence of light and air, and it is from the axils of the leaves at the nodes that the tuber-bearing rhizomes arise. This, no doubt, explains in part the increase in yield obtained by the use of properly sprouted "seed." At the same time the tubers themselves become "greened," and to this "greening" as much as to sprouting, must the benefit of the practice be ascribed.

"Seed" tubers may also be stored satisfactorily in half petrol tins freely perforated with holes, or open wooden crates, such as those in which imported seed arrives. They must be stacked under fairly heavy shade to give protection from the direct rays of the sun. Messrs. Newmarch and McLean, the largest growers of main crop table and "seed" potatoes in the Colony, utilise the imported seed crates, which are stacked one above the other, with space between the layers for the free circulation of air, under the shade of a thick canopy of plantains, as shown in fig. No. 2 (August issue, *R.A.J.*). One great advantage of this method is that it saves handling, as the seed can be carried straight to the field in these crates. A disadvantage, however, is that potatoes so stored cannot be conveniently inspected periodically for the purpose of removing diseased tubers. Another method of storage used by them is shown in fig. No. 3

(August issue, *R.A.J.*). The tubers are lying on the bare ground, which is smooth and hard.

Tobacco barns may be utilised for this purpose, care being taken to admit sufficient light and air. The tubers should be stored in layers of not more than two or three tubers deep, to avoid the production of long weak shoots. In such barns the rate of sprouting can be accelerated, if desired, by raising the temperature by lighting small fires and keeping the air moist.

Whatever system of storing tubers for sprouting is adopted, it must be designed to give protection from frost and sun-scald, and yet allow of the free play of air and light round the tubers when and as required.

Potatoes cannot be stored in earth-covered "clamps" or in pits, as is done in Northern Europe. It was found at the Agricultural Experiment Station, Salisbury, that a covering of more than two inches of dirt caused potatoes to form long weak sprouts, and less than one inch of dirt failed to protect them from the heat of the sun in September and October.

Acceleration of Sprouting.—Farmers who grow potatoes under irrigation for the early market during the winter often have difficulty in securing sprouted "seed" for planting, or inducing their own "seed" to sprout sufficiently early. Some growers of main crop potatoes, too, who prefer to use "seed" grown under irrigation in winter, have a similar difficulty. This is, of course, due to the fact that the potato tuber requires to pass through a resting period of from two to four months after maturing, during which the "eyes" remain dormant. This dormant or rest period may be terminated by cutting the tuber in half transversely, as was shown by Appleman at the Maryland Experiment Station, but the use of "cut" seed is often inadvisable, and does not give such good results as whole sprouted "seed." A solution of this problem has been discovered at the Agricultural Experiment Station, Salisbury, during experiments on fumigating potatoes with carbon bisulphide to kill "tuber-moth."

The tubers should be placed in an air-tight room, or receptacle, such as a corrugated iron tank. A pit in the ground covered with a tarpaulin has not proved satisfactory,

probably owing to the vapour being absorbed by the earth. On the other hand a tarpaulin covering to an iron tank would be satisfactory, since the vapour is 2.6 times heavier than air, and so will not tend to rise and find its way through the tarpaulin.

Carbon-bisulphide should be placed in shallow trays or dishes on the top of the "seed" tubers and the room or receptacle closed. The liquid evaporates readily on a warm day, and the vapour being heavier than air, flows over the sides of the trays and fills the receptacle. It is advisable to commence the treatment on a warm morning, so that the liquid will evaporate rapidly. The tubers should undergo the treatment for 24 to 48 hours, and two tablespoonfuls of the carbon bisulphide are required to each cubic yard, or 27 cubic feet of volume of the receptacle, irrespective of whether the latter is filled with tubers or only partly so. Within ten days about 75 per cent. of the "seed" should be commencing to sprout. When sprouting has commenced, it may be further accelerated by placing the tubers in a gently warmed tobacco barn or in a warm room, in which the air is kept reasonably moist. It is useful to know that carbon-bisulphide is sold by the pound weight. One pound is equivalent to approximately 13 ounces (liquid measure), or 26 tablespoonfuls.

Warning.—It should always be carefully borne in mind that the vapour of carbon-bisulphide is highly inflammable and explosive. It is also poisonous, and the greatest care should be exercised in handling this material. No naked lights, not even a lighted cigarette or tobacco pipe may be permitted anywhere in the neighbourhood of where it is being used. It is dangerous to switch on an electric torch in the presence of the vapour, since small sparks at the switch may cause an explosion. A room which has been filled with vapour should be left open to ventilate for several hours before it is entered.

F. E. Denny* has recently shown that soaking seed potatoes, within one month of digging, in a .3 to .4 per cent. solution of commercial ethylene chlorhydrin for one hour, or by exposing the tubers to the vapour for several hours, the resting period is cut short, and they are caused to sprout.

* *American Journal of Botany*, vol. xiii., p. 48.

Potassium or sodium thiocyanate in 2 per cent. solution for one hour had a similar effect, and a 1 per cent. solution of thiourea for one hour, not only cuts short the resting period, but also has the effect of breaking down the inhibitory effect of the apical "eye" over the other "eyes." These materials have not yet been tested in this Colony.

Appleman has demonstrated in his studies on the resting period that if the tubers were kept moist and well aerated, the rest period is shortened, but if the skin of the tubers became hard and dry, then sprouting was delayed. If, therefore, tubers are placed as soon as they are lifted in a warm sheltered place in the open, where they are spread out and covered with a single layer of moist sacking, which is kept moist, then sprouting is accelerated.

Selection of "Seed" Tubers for Freedom from Disease.— All tubers showing any signs of "rot" or "scab" should, of course, be discarded at once.

Abnormally-shaped tubers should be rejected, since recent research has shown that such abnormal shape may be due to the presence of a virus disease called "Spindle-tuber," which causes a marked decrease in yield. The tubers become elongated towards the "heel," are often irregular in shape, and the "eyes" become deepened. Tubers with long spindly sprouts should be rejected, since they are invariably infected with the Leaf Roll form of virus disease. A further sign of this disease in the tuber may be seen when it is cut transversely near the heel end. A fine network of brown lines may be visible, this condition being known as "net necrosis."

In varieties normally having deep eyes, those tubers having shallow eyes should be discarded, since they may be "rogues," or may be infected with Mosaic. Splits, excavations and blisters on the surface of the tubers may be the signs of infection by a disease known as "Stipple Streak," and tubers showing these symptoms should be rejected.

Although one or two of the diseases mentioned above have not so far been reported in this Colony, their appearance may be expected and guarded against as far as possible. The Plant Pathologist of this Department has already noted

the presence of six varieties of virus diseases.* Unfortunately it cannot be considered that if tubers show no signs of virus infection such as those mentioned above, they are therefore free from it. Disease cannot be eradicated by tuber selection, but its extent and spread may be materially reduced thereby.

Use of Immature Seed and Effect of Locality of Origin. It is an almost universal custom amongst British growers of "seed" potatoes to lift their crops whilst the tubers are still immature. Generations of experience have shown that immature seed gives better results than seed allowed to mature in the ground, but the true explanation of this phenomenon is still in doubt. It may be due to some intrinsic value which immature seed possesses, or it may be due to the immature seed being freer from infection by virus disease. Both opinions have their supporters, but, as pointed out by Salaman,† "In practice it makes but little difference whether the improvement in yield obtained by the use of immature seed is ascribed to its immaturity or to its freedom from virus infection."

The best seed undoubtedly comes from the colder regions, such as Scotland and Northern Ireland, and it has been established that its particular value arises from the fact that it is freer from infection by virus diseases owing to the fact that the common insect distributing agents of such diseases, namely, the green fly or aphis, and probably some of the leaf hoppers, are not met with so commonly in these areas as in the more southerly parts of the country. It is possible the strong preference shown by some experienced potato growers in this Colony for seed potatoes raised on the high sandveld in winter may be due to similar causes.

The question of the use of immature seed has been investigated at the Agricultural Experiment Station, Salisbury, during the past season in an experiment, of which the results are tabulated elsewhere in this article, but the results obtained were not conclusive.

* *Rhodesia Agricultural Journal*, June, 1930. "List of Plant Diseases Occurring in Southern Rhodesia." Reprinted as Bulletin No. 788.

† "Potato Varieties," by Redcliffe N. Salaman.

Size of the Seed.—Dr. Salaman's investigations in England have shown that the size of the seed has a very considerable influence on both the total yield and also on the proportion of heavy and light ware potatoes in the resulting crop. His research on this point was done on an extensive scale over a period of three years. His results are tabulated below. The yields are given in long tons.

Size of seed.	Total crop in tons.	Heavy ware, 3.2 ozs. and over.	Light ware, 3.2 to 2.0 ozs.	Chats below 2 ozs.	Weight of seed in tons.
Ozs.		Tons.	Tons.	Tons.	
4.0	11.8	6.0	2.65	3.1	1.8
2.6	11.8	7.7	2.3	1.8	1.2
2.0	11.5	8.4	1.4	1.7	0.91
1.6	11.0	8.07	1.73	1.2	0.73
1.3	10.7	7.8	1.4	1.5	0.61
1.0	10.6	8.25	1.2	1.15	0.46
0.8	10.0	8.0	0.8	1.2	0.36
0.57	9.07	7.2	0.8	1.07	0.26
0.35	8.3	6.9	0.7	0.7	0.16

It will be seen that a much higher proportion of large ware potatoes is obtained from the small sized sets than from the larger sets, but a greater total weight of large and small ware is obtained from sets of 1.6 to 2.6 ounces than from sets of larger or smaller size.

The following table is obtained from the figures in the above table by subtracting the weight of seed used from the total weight of large and small ware.

Size of seed in ozs. ...	4.0	2.6	2.0	1.6	1.3	1.0	0.8	0.57	0.35
Nett yield of ware potatoes in tons (long), less the weight of seed used	6.85	8.8	8.89	9.07	8.59	7.99	8.44	7.74	7.44

It will be seen that sets weighing 1.6 to 2.6 ounces each have given the greatest nett total yield of ware potatoes, that is, of tubers weighing from 2 ozs. upwards. From these figures it is seen that it would best pay the grower of table potatoes only to plant seed of 1.6 ozs. weight.

If, however, a grower is selling seed as well as table potatoes, the respective prices obtained for seed and table potatoes must be taken into account. Reverting to the first table, if we consider, for the sake of argument, that the light ware potatoes are sold as seed at £1 per bag of 150 lbs., and the large ware are sold as table potatoes at 10s. per bag, we obtain the following table of gross returns from the different sizes of sets:—

Size of seed in ozs. ...	4.0	2.6	2.0	1.6	1.3
Gross return at £1 per bag of seed and 10s. per bag of table potatoes	£84.75	£92.2	£84.5	£86.45	£79.5

From this table it will be seen that it will pay the grower of seed potatoes best, at the quoted prices, to plant seed of rather larger size, viz., 2.6 ozs., but seed larger than this would not pay so well, nor similar seed.

Salaman has also shown that the total yield of a crop varies directly with the size of the seed tubers, as is seen in the table of results given below, which needs no explanation:—

Weight of seed tubers in ozs.	4.0	2.66	2.0	1.6	1.33	1.0	0.8	0.57	0.35
Weight of crop in lbs.	86	81	79	78	74	73	69	62	54

His results have been confirmed by a number of other workers in Great Britain, Germany and America.

The results obtained at the Agricultural Experiment Station, Salisbury, agree with these findings in regard to the variation of total yield directly with the size of seed tubers, but not on the question of the variation of the proportion of ware in the crop inversely with the weight of the sets. The results obtained are set out below. The experiment was carried out on quadruple plots, and the variety grown was the Up-to-Date, the seed being taken from a strain which had been grown in this country for six years previous to the commencement of the experiment.

Yields per Acre given in Bags of 150 *lbs. each.*

Size of seed tubers, ozs.	Large.	Size of progeny. Medium.	Small.	Total yield.	Percentage of large tubers of total yield.
3	37.0	15.6	7.4	60.0	62
2	23.2	13.0	5.0	41.2	56
1	11.6	9.6	6.8	28.0	41

It will be noticed that there is a much more rapid drop in the total yields from the 3 or 2 oz. sets to that of the 1 oz. sets than in Salaman's experiment. With regard to the proportion of ware potatoes, it will be seen that these results are diametrically opposed to those obtained by him.

It is thought that these differences are due to the fact that the strain of seed used for this experiment had been grown in this Colony for six years since the importation of the original seed from Scotland, and during this period has become more or less infected with virus diseases, which fact has disturbed the normal response of the variety to environmental factors. Owing to the system of rough bulk selection of tubers which this strain has undergone for six years, it is thought probable that the larger tubers have a greater tendency to freedom from virus disease, and the smaller tubers have a greater tendency to carry the disease, since virus diseases cause a marked increase in the proportion of small tubers produced.

(To be continued.)

WANTED.

Salisbury Agricultural Experiment Station.

ANNUAL REPORT, 1929-30.
(Concluded.)

By H. C. Arnold, Manager.
(Published with the approval of the Chief, Division of Plant Industry.)

Soya Beans.—The need for a leguminous hay crop which can be grown during the summer rains and which can be reaped with the aid of modern mechanical devices has long been recognised, and of the many plants which have been introduced and tested with this end in view, certain varieties of Soya bean have given the most promising results. In the maize areas in America the acreage under Soya beans has increased very rapidly during recent years, and this fact suggests that the crop may yet prove equally valuable in the maize areas of Southern Rhodesia.

Among the many varieties which have been tried, it has been found that only those which require a comparatively long growing period are suitable for cultivation in this Colony. It is interesting to note that all the varieties have a shorter growing period here than they have in America, and this may be a factor in reducing the yields obtained in this Colony.

For example, in Southern Rhodesia "O-too-tan" requires about 130 days from the date of sowing to the date of reaping the seed, while in America it requires 175 days to reach maturity. Observations show that the period of growth of

all varieties is curtailed in Southern Rhodesia by 30 to 45 days, and that the early maturing varieties in particular are thus adversely affected and yield but small crops of seed or fodder.

The O-too-tan variety has out-yielded all others which have been tested here, and although its black seed may not be favoured by the oil trade, which gives preference to yellow seeds, its value for hay or silage is not diminished by the colour of the seed coat. A yellow-seeded variety called Herman has also given moderately good results. Unfortunately, this crop does not thrive well on soils of low fertility. One of the reasons for this may be the absence of the particular strain of nodule-forming bacteria which are associated with it, or that the chemical composition or high temperature or other conditions of our soils do not favour the development of these particular bacteria.

The heaviest crops have been reaped on land which has previously been liberally supplied with farmyard manure, and under such conditions O-too-tan has produced fodder yields which compare favourably with those of dolichos beans and velvet beans grown on the same land.

The uneven ripening and shedding of seed within a few days of its reaching maturity are rather serious drawbacks to the Soya bean crop. With most varieties harvesting operations must be commenced immediately the leaves fall, or even before that stage has been reached, to avoid losing a considerable portion of the grain crop. Through the courtesy of the Department of Agriculture of the Union of South Africa, we now have a variety which retains its seed for two or three weeks after maturity, and although the yields of this kind are not large enough to warrant extensive cultivation, it may be possible by selection or by cross-fertilisation to combine its desirable quality with the heavy yielding propensities of other strains.

Soya Bean Varieties.

Yields in lbs. per Acre.

Name of variety.	1929-30. Hay.	Seed.	1928-29. Hay.	Seed.	1927-28. Hay.	Seed.	Average over 3 seasons.	
O-too-tan ...	3,316	825	4,608	1,309	2,080	680	3,335	938
Herman ...	3,146	1,210	4,459	1,210	1,526	574	3,044	998
Biloxi ...	1,634	260	3,510	552	3,160	160	2,768	324
Chiquita ...	968	926	2,730	968	1,088	254	1,595	716
Dixie ...	3,146	847	2,639	955	1,022	224	2,269	675
Chinese White	1,118	982	4,580	1,188	...	...	2,849	1,085
Southern ...	1,694	646	4,410	506	...	...	3,052	576

A number of new varieties which have been received from various sources were included for the first time in our variety trials this year, but none of them has so far yielded heavier crops of either fodder or grain than O-too-tan or Herman. The new varieties include the following:—Black Eyebrow, Brachet, Brown, American White, George Washington, Laredo, Goshen, Morse, Mammoth Yellow, Mammoth Brown, Tokio, Tarheel, "Soyolk" Yellow ex Uganda, Black ex Uganda.

A large number of strains which appear to have arisen through the hybridisation of O-too-tan and Biloxi have been isolated. Most of these are more robust than the former, and a number promise to give better yields than either of the parents. These must continue to be tested for another year or two before any superiority which they may possess can be established.

Sweet Potatoes.—Satisfactory yields of sweet potatoes have been produced each season on this station for a period of more than 15 years, and it is probably on account of its reliability that this crop has so increased in favour with farmers who require succulent winter feed for live stock.

Although in establishment it calls for little more labour than such crops as pumpkins and melons, the extra trouble is amply rewarded by large returns of green vines and tubers. On fertile soil, heavy crops of tubers may be obtained for at least two seasons in succession, and a luxuriant growth of tops will be available for a further period if the land is ploughed each year and kept free of weeds.

A continuous supply of succulent food, extending throughout the whole year, in the form of either tops or tubers, may be obtained from a well-managed field of sweet potatoes. But owing to the difficulty of keeping control of weeds, it will usually be found better practice to rotate the potatoes with other crops after the second or third year.

In view of the usefulness of this crop, many varieties have been introduced and tested, and of these the Early Butter, Calabash Leaf and Common Pink have consistently yielded well. A more recent introduction known as Linslade has produced both vines and tubers in large quantities over a period of five years, and as a dual purpose variety may prove slightly superior to the others mentioned.

Sweet Potato Variety Trials.

Yields in lbs. per Acre.

Name of Variety	Average weight of tubers over 7 years	Average yield of green tops over 7 years
Early Butter	17,137	16,007
Calabash Leaf	13,211	19,970
Common Pink	17,623 (over 5 years)	12,731 (over 5 years)
Linslade	16,525 (over 3 years)	17,792 (over 3 years)
Oklahoma	9,314 (over 2 years)	17,322 (over 2 years)
Yellow Jersey	15,179	9,106
Southern Queen	12.719	18,538
Porto Rican	9,335	12,967

For the past five years a part of each plot in the variety trials has been allowed to remain down, with the object of ascertaining the advisability of relying on a volunteer crop for the second year. It has been found that the yields of the second crops have been somewhat less than those of the first, but on the whole very satisfactory results have been recorded. The second season's tubers are usually smaller than those of the first season, and unless care is taken to reduce the stand of volunteer plants to approximately one plant to each half square yard, it may be found that the resulting return will consist of numerous small tubers whose lack of size may considerably reduce their value.

Sweet Potatoes: Volunteer Crop.

Yield of Tubers in lbs. per Acre.

Name of Variety	First year's crop for comparison	Volunteer crop 1929-30	Average of 5 season's volunteer crops
Early Butter ...	11,809	11,920	11,907
Common Pink ...	13,101	10,025	10,489
Calabash Leaf ...	12,306	5,860	5,772
Red Nancemund ...	14,148	5,580	6,121
Linslade ...	16,200	10,160	9,769

These returns indicate that some varieties are more productive than the others during the second year, and over the five-year period, Early Butter and Common Pink have consistently produced heavier volunteer crops than the others, thereby proving their superiority as producers of tubers, though the Calabash Leaf has maintained its lead for the production of green tops.

The yield of green tops from the volunteer crop averages slightly less than that of the first year, in spite of the advantage they have in being able to commence their growth earlier in the season.

During the course of these trials it has been noticed that the foliage of a volunteer crop is more frequently attacked by insect pests than that of the first crop. This fact, combined with decreased yields and the difficulty experienced in keeping the land free of weeds, affords sufficient reason for not leaving the crop down for more than two or at most three seasons.

Edible Canna.—Very favourable reports have been received from farmers who have established this plant with a view to the provision of succulent winter feed for stock. The chief reasons for its increasing popularity are the ease with which it can be cultivated, the heavy crops of succulent food it furnishes, the availability of its green tops and corms at all seasons of the year without resource to irrigation or preservation, and perhaps the fact that the native has not yet acquired a taste for it.

In this Colony the heaviest crops are produced on fertile soils when the rainfall is plentiful and extends for a long period, accompanied by high temperatures. Its growth is limited during the winter months by low temperatures and

lack of moisture. Under irrigation it continues growth throughout the year, except, perhaps, in districts which experience severe frosts, which temporarily check its progress. It does not thrive well on very poor soils or on those which are water-logged.

If the weather conditions are favourable, nearly all the transplanted crowns will survive if reasonable care is taken to use only those which are sufficiently mature and well developed, though not too old. Corms should be planted about three feet apart each way, and as early in the season as the commencement of the rains, or, if preferred, shortly before the rains break. In order that the plants may become well established, their tops should not be removed during the first season until their rate of growth is curtailed by low temperature. When established securely, the matured top growth can be removed during the summer months without seriously interfering with the development of the crop, but it should be remembered that underground growth cannot take place in the absence of top growth, so that the removal of the entire top growth, and especially that which is immature, should be avoided during the summer months.

In Southern Rhodesia the canna is mainly used for the same purposes as the sweet potato, and whether or not it is superior to that crop remains to be proved. The chief disadvantage of the canna is that it cannot be propagated from stem cuttings, and this necessitates the reservation of a considerable portion of the crop of corms for propagation purposes, which otherwise would have been available for use as winter food. This disadvantage is offset somewhat by the keeping qualities of the canna corms, which, without deterioration, can remain in the ground and multiply for two or more seasons.

With a view to ascertaining the relative yield power of the two crops over a two-year period, alternate plots were planted in 1928 with Early Butter Sweet Potatoes and Canna. A crop of sweet potatoes was lifted in 1929 and a second crop of tubers was taken during the season under review. The canna corms were not lifted at the close of the first season,

the green tops only being removed in June, 1929. The results are tabulated below:—

Edible Canna versus Sweet Potato Trials.

Yields in lbs. per Acre.

	Canna.			Sweet potatoes.			
	Green tops.		Corms.	Green tops.		Tubers.	
Season	1928-29	1929-30	1929-30	1928-29	1929-30	1928-29	1929-30
Yields	14,720	34,520	37,260	19,180	17,390	26,120	10,120
Totals two seasons	49,240		37,260	36,570		36,240	

If the amount of corms required for "seed" for the canna crop (about 2,000 lbs.) is deducted from the yield, it is seen that the sweet potato produced 1,000 lbs. per acre more tubers than the canna, and, moreover, the greater part of this return was available during the first season. The canna, on the other hand, produced 13,000 lbs. per acre more green tops than the potatoes. Further, it was found that the canna tops contained 14.2 per cent. of dry matter, against 9.5 per cent. in the potato, whereby it may be assumed that the total food value of the canna tops was greater than that of the sweet potatoes. Canna tops, however, are somewhat unpalatable to cattle until they become accustomed to them, and it has been noticed that although cattle prefer the leafy parts, pigs give preference to the stems. If the stalks are chaffed and mixed with dry foods, cattle will eat both with relish.

The palatability of both tops and tubers of sweet potatoes is well known. It appears, therefore, that there is very little difference in the productive power of the two crops, for although some varieties of sweet potato yield a heavier crop of tubers than the canna, the latter yields considerably more fodder in its top growth, and this tends to balance the total production of the two crops.

Poultry Husbandry in Southern Rhodesia.

THE IDEAL BROODER.

By F. Roberts, Assistant Poultry Officer.

The brooder described in this article was designed by the writer in an attempt to construct a simple, efficient and cheap brooder which would obviate the handling of chicks and over-crowding, and provide thorough ventilation. In short, one that would embody all essentials for the health and comfort of the chicks, and at the same time be as near natural conditions as possible.

This brooder consists of an iron disc supported on four legs 8 inches high, with 3 wire rings to which flannel is attached, and then cut into 2-inch strips. These rings are attached to the disc at specified intervals.

The heat is supplied by means of a hurricane lamp, which is placed in the centre and surrounded by a fine mesh wire guard. This lamp serves not only to provide the necessary heat for the chickens coming direct from the incubator, but the light attracts them when darkness sets in, and there is consequently no handling, and accidents are reduced to a minimum. Further, it has the advantage of being labour-saving, and it is not absolutely essential to be with the chicks when bedtime comes. Having three separate compartments of varying temperatures, the chicks surrounding the lamp in the inner compartment can, if they become too warm, move freely outwards. There is thus no danger of over-heating. In brief, the advantages of this brooder may be summed up as follows:—

1. There is no sudden change of temperature, as in the case of cold brooders, either from incubators to brooder or from brooder to outside temperature when the chicks are put out in early morning.

2. There is no over-heating as is apt to be the case with many hot brooders.

3. There is no smothering as with cold brooders, in which chicks crowd into corners to get warm before attention is given to them.

4. There are no fumes, gases or foul air. The ventilation is perfect. Fresh air coming in from all sides gradually becomes warm, and, with the foul air, rises and escapes through the top.

5. The handling of chicks is reduced to a minimum, and consequently the number of accidents is infinitesimal.

6. Provided the lamp is adjusted beforehand, one can leave it and attend to other work freely, knowing the chicks are safe and satisfied.

7. There is entire freedom for the chicks, in that they can run in and out at all times. Consequently, they are in better health, eat more and mature quicker than chicks in other brooders.

8. No chick is ever left out of the brooder, for the inmates will always make for the light and settle down contented with the other chicks.

9. The heat from the lamp is radiated from the roof on to the backs of the chicks. This approaches very closely to natural conditions.

10. Besides the hardening effect obtained by the lowering of the temperature from the lamp to the outer edge of the brooder, the chicks may be gradually and systematically hardened off from day to day by manipulating the lamp and rings of flannel.

11. The chicks become used to this brooder and will nestle in it at night, even after lamp and rings have been removed.

12. This brooder is constructed and run at very small expense.

13. The percentage of deaths is very low.

How to Manipulate.—The brooder is placed for preference in a small, sunny or warm rondavel or room, the floor of which is covered with litter (wood shaving or finely-cut chaff preferable). The brooder should be placed in the centre of the room with the lamp guard in position and the lamp burning. The chicks are taken direct from the drying box of the incubator, preferably in the evening, and are placed under the brooder as near to the lamp as possible, which is inside the inner circle of flannel. From now onwards it will not be necessary to handle a single chick again until it is big enough to be transferred to other quarters. In very cold weather the lamp should be kept burning both night and day for about three days, after when it should be lit just before sundown and removed in the morning at about 9 o'clock. Each night the flame of the lamp should be turned a little lower than on the previous night. After a week the lamp should be removed altogether, thus giving more space to the rapidly-growing chicks. The cost of fuel consumed during this period would approximate 1s.

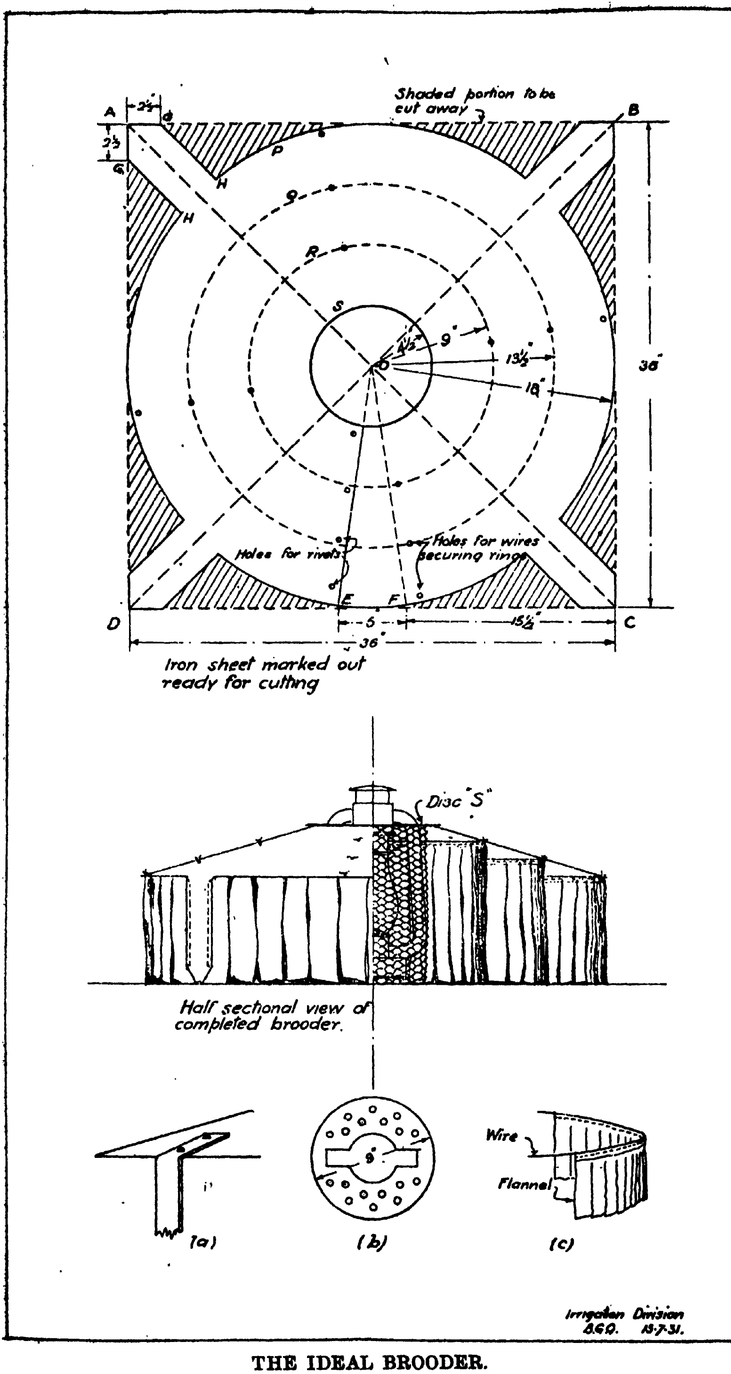
At the end of the second week the inner circle of flannel is removed. After three weeks the middle circle is removed, while the third and last circle should be removed at the end of the fourth week.

The chicks will still continue to sleep under the iron cone-like structure until they are big enough to be removed to other quarters. This brooder will hold and rear approximately 150 chicks.

Construction.—In the accompanying illustration the diagram A, B, C, D represents the four corners of a sheet of 22 gauge galvanised sheet iron, 3 feet square. (Such iron is sold in sheets 6 feet by 3 feet.)

With the centre point O and a radius of 18 ins., describe the circle P, and with the same centre and radii of a 13½ in., 9 ins. and 4½ ins. respectively describe the circle Q, R and S. Mark the points E and F 5 ins. apart, and draw a line from each of these points to the centre O.

From each corner measure off distances of 2½ ins. to the points G, G, and with a straight-edge reaching from corner to corner draw the lines G, H parallel with the diagonals. This marking out, which is now complete, can



THE IDEAL BROODER.

(a) Alternative method of constructing legs.
(b) Disc "S" for closing top of cone.
(c) Showing how flannel is attached to wire rings.

be done with a lead pencil or by scratching the iron with a sharp nail. The circles can be described with a compass, made by driving two nails, at the correct distance apart, through a strip of wood of sufficient size to hold the nails firmly, about ¾ in. x 1 in. x 21 ins. Now, with a pair of tinman's snips or cold chisel and hammer, cut away the shaded portions at the corners and cut out the centre disc, which will be 9 ins. in diameter; also cut along the line EO.

The sheet is now formed into a shallow cone by bringing the cut edge OE to the line OF, where it must be secured by punching or drilling about four small holes through both thicknesses of iron and lacing with wire or riveting them together. Tinman's flat-headed copper rivets will be found very suitable for this work and easy to use.

The four-corner projections which are to form the legs should now have their edges bent inwards to give them additional stiffness before they are bent down as shown. If preferred, the sheet of iron can be cut to a complete circle and have four legs made of stout hoop-iron, about 1 in. x 1-16th in. in section, riveted on as shown at A in the illustration. Three rings of No. 8 gauge fencing wire must be made, one to correspond to each of the circles R, Q and P. It must be remembered that these circles are now smaller than they were when originally marked out, by reason of the iron having been reduced to the form of a cone.

A strip of thick flannel or similar material is now sewn to each ring, so that it forms a circular curtain, as shown at C. The width of each strip, in order that it may just reach the floor, will be approximately as follows:—For ring P, 7½ ins.; Q, 9 ins.; and R, 10 ins. Actually, they should be left a little wider, so that they can be trimmed off to the correct length when the brooder is assembled. These flannel "curtains" are now cut vertically into strips 2 ins. wide. The wire rings with the flannel attached are now attached to the underside of the cone by means of thin pieces of wire passing through small holes punched therein as shown in the illustration.

The 9-in. diameter disc cut from the centre of the sheet is now shaped as shown at B, to fit roughly round the top of the hurricane lamp. As these lamps vary considerably in

design, no dimensions can be given. A few holes are punched round the edge for ventilation purposes.

A piece of ½ in. mesh wire netting or mosquito gauze, of sufficient size to wrap round the lamp and form a guard to prevent the chickens getting too close, completes the brooder.

Gwebi Produce Prices.

Salisbury White, seed maize ...	42/- per bag of 200 lbs.
Salisbury White, seed maize (tips and butts)	15/- per bag of 200 lbs.
Hull-less oats	40/- per bag of 150 lbs.
Spanish Bunch nuts (unshelled)	15/- per bag of 75 lbs.
Spanish Bunch nuts (shelled)	60/- per bag of 180 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Majorda seed	1/1 per lb.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

Reviews.

"AGRICULTURAL POLICY IN SOUTH AFRICA."

(By HUBERT D. LEPPAN, Professor of Agricultural Economics, Pretoria University. Central News Agency, 6/-).

This is a candid but constructive criticism of the agrarian policy in South Africa by one who is well qualified to write with authority on a subject of this magnitude. Professor Leppan postulates that only 15 per cent. of the Union of South Africa is arable, and that the remaining 85 per cent. can never be utilised except for pasturage. He therefore considers that the animal industry rather than the production of crops should dominate the agricultural policy of the country. A re-orientation is necessary. He advocates the curtailment of expenditure on spectacular irrigation schemes which outstrip the economic situation in farming, the abolition of the duties on wheat and peanuts within ten years, and the gradual elimination of the sugar duty, so as to enable a measure of State aid to be given to develop the animal industry. Professor Leppan stresses the importance of pasture research, and while he considers that much can be done to improve the indigenous grazing, he feels that the greatest advance will come from the establishment of artificial pastures. In reviewing various aspects of the animal industry, the author considers that the trend of past policy has been to stress protective measures, veterinary and otherwise, to the neglect of improvement in quality. More than this, he holds that far too little consideration has been given to the disposal of the final product. For these reasons alone, Professor Leppan views the present policy of the Government in placing the Animal Husbandry Division under the administration of Veterinary Research and Science with misgiving. He considers that it will divert the veterinarians from their legitimate activities and will tend to accentuate a bias at present wrong, namely, to subordinate the other functions of a properly directed animal husbandry to that of animal protection—in other

words, the business side of these services must tend to be neglected or the veterinary work of the country will suffer.

Professor Leppan is emphatic that long-range research in agriculture is best left to bodies outside of direct State control, *e.g.*, universities and other technical institutions. His point is that however able the Civil Servant may be, the best research work cannot be done when he is hampered by the inevitable restrictions and routine common to all State services. Added to this, the continuity of investigational work too often suffers because of changes brought about by political pressure, administrative demands and so forth.

The book will undoubtedly evoke considerable discussion and will direct attention to a subject of vital importance to the South African, and not without significance to the agriculturist in Southern Rhodesia. No attempt is made to obscure unpleasant facts, and a feature of the book is the clarity of expression. If the outcome is the advancement of the agricultural industry and the uplifting of the man on the land it will have served a national purpose and the author will have deserved well of his country.

W. E. M.

"PRACTICAL HANDBOOK OF WATER SUPPLY."

(By Frank Dixey, O.B.E., D.Sc., F.R.G.S., F.G.S. Thomas Murby & Co., 1, Fleet Lane, E.C. 4.)

In this publication the author, who is Director of the Geological Survey, Nyasaland, has made a valuable contribution to the knowledge available on water supply problems in the tropical and sub-tropical portions of Africa.

The case for a constructive and defined policy in order to husband and develop the water supply resources of a country is ably presented. In this connection the importance of extending forest reserves, the necessity for retaining forest and bush cover on the hills and watersheds, and the protection of vegetation along the banks of streams and rivers is particularly stressed. Further, the improvement capable of being effected in river systems by the construction of water conservation works is referred to, and a plea put in for a more

active programme of investigation followed by constructive development. The book will be a useful reference work for administrative officials and others who may be faced with the problem of developing water supplies in outlying districts and controlling a water conservation policy. Farmers and ranchers will also find a fund of valuable information available to direct their efforts on the right lines in developing the water supply resources of their farms. All the technical information is presented in plain, straightforward terms, and the text is illustrated with numerous diagrams, sketches and photographs, so that the advice given can be readily followed by a practical man.

As is natural in a publication of this nature, the author has freely drawn on the authoritative data available in bulletins issued by the various Colonial Agricultural and Irrigation Departments, and in this connection it is flattering to note the extent to which our local publications have been utilised.

The portion of the book dealing with the geological aspects of underground water supplies is of very special value and should be consulted by everyone who is intending to sink for water.

Other chapters of the book dealing in the fullest detail with matters of importance to farmers are those relating to construction of tanks and dams, well-sinking methods in various types of strata, and the installation of pumping equipment.

C. L. R.

Farming Calendar.

September.

BEE-KEEPING.

This is an important month for the bee-keeper, as it starts the first flow of the season. All hives that were sent into winter quarters on a double brood chamber, or otherwise with ample food for that period, should now be overflowing with young in all stages and with a population large enough to take full advantage of the flow. All hives should be carefully examined now and again, entrances opened out to suit the advancing warmth of the weather, and where necessary ventilator lids replaced on the top crates under the hive lid. See that no worry is caused to the bees by ants getting up, and that ample stores of good water (with a pinch of salt and a dash of vinegar) are available for drinking purposes, of which bees consume quite a lot. Swarms can now be looked for; if not required, they can best be destroyed by carbon bisulphide or calcium cyanide—both requiring very careful handling. If it is wanted to increase the apiary, as soon as the scouts are seen looking round for a home, get the decoy hive ready filled with dummy and proper frames of full foundation sheets, or, better still, if they are available, old drawn out brood combs, and as soon as it is taken possession of, insert if possible a frame or two of unsealed brood. As a rule the swarm will settle down at once. Such a colony is best placed in the apiary the same evening, if it can be so arranged. Do not make the mistake so often seen of supplying the new colony with starter frames only; give them full foundation sheets; it pays every time, and more especially so in the first early honey flow. Be sure also and protect the apiary against that persistent robber, the honey bear or ratel, by fencing it with fowl netting and pegging that down with wooden pegs every two feet. The two-footed robber can be just as effectively dealt with by placing a small light chain round the entire hive fastened with small staples and a padlock.

CITRUS FRUITS.

The fate of the citrus fruit crop is dependent upon the treatment the trees receive during this month. If the trees have been given the treatment recommended in the August calendar, and this treatment is followed by good irrigations and cultivation, a good crop of fruit may be expected, whereas a total failure will be the result if the trees suffer for want of moisture at this season of the year.

If not already done, all top worked trees should be headed back early in the month. This cutting back will induce the dormant buds (set in autumn) to commence growth. As the new shoots develop the old tops may be further shortened back until the old top is displaced with a new but profitable one.

The packing of late varieties must be speeded up and completed, if possible, by the end of the month, as the late picked fruit is likely to deteriorate in quality or come into competition with Mediterranean fruits.

All adventitious shoots (water shoots and suckers) must be cut off as they appear, and this work should be continued throughout the growing season.

CROPS.

Utilise your labour to the fullest extent for stumping and clearing more land for mixed crops and for general farm development. Do not be satisfied unless each year sees more profit-earning development work effected. Good organisation of the farm work will permit of much being done without great cost. Begin marking out holes for hand check-row planting of maize, and apply manure or fertiliser. Fertilisers which are to be broadcasted and ploughed or harrowed in can be applied. Do not forget that lands which have been green manured in March or April will require a second ploughing about this date or before being seeded to crops. Early varieties of winter cereals ripen this month and require harvesting. Danger from frost should be past now, and crops susceptible to frost, such as potatoes, onions in beds for the summer crop and Jerusalem artichokes, may be planted where lands are moist. Pumpkins and early maize may be planted on vlei lands. Edible canna may be planted "dry" during the latter half of this month, where some rains may be expected during next month. Overhaul all implements and replace worn parts. Putting this off till the planting season may mean serious loss of planting opportunities between rains. Get out the planters and seed drills. Overhaul and place them in proper working order. Ploughing and cross-ploughing should be hurried on with; also the ploughing under of farmyard manure. A spiked roller can usefully be employed for breaking down clods, particularly on those lands which are to be planted first. Make every effort to secure as good a seed-bed as possible; good seed-beds mean good stands, and good stands are all-important in securing good yields.

DAIRYING.

This is generally the quietest month of the year from a dairying standpoint. Most farmers have by this time exhausted their supplies of winter feed and the production of dairy products is consequently at its minimum. Town milk supplies are now falling off, and a greater use of purchased concentrates in the form of ground nut cake and bran is advisable to keep up the milk supply. Very little cheese is made during this month and stocks are naturally low. Old cheese should be cleared out of the storeroom before the advent of hot weather, and if possible should be sent to be stored under cold storage conditions. Considerable difficulty is to be expected in making butter during this month, as the early spring grass is shooting in the vleis and the butter is consequently very soft. To counteract this, greater use should be made of cotton seed cake, of which a small supply is expected to be available this season.

DECIDUOUS FRUITS.

Newly planted trees must not be permitted to become too dry; watering by hand or gravitation must be continued until the rains commence. Ten gallons of water every fourteen days is sufficient for young trees; these applications should be followed by the loosening of the soil to prevent undue evaporation of the added moisture.

All undesirable growths on the stem and in the centre of the trees should be suppressed as they appear; this will enable the retained shoots to develop normally.

Early fruits must be thinned out this month; only retain two or three fruits on each bearing twig or shoot. Those that are left will then develop into large and attractive fruits.

ENTOMOLOGICAL.

Cotton.—Prevention for most of the boll-worms will be the proper preparation of the ground, with thorough cultivation and eradication of all weeds on the land, particularly those of the family Hibiscus. Wild host plants for stainers should be sought out and destroyed.

Tobacco.—Young plants in seed-beds may suffer from cutworms. Frequent cultivation and laying down of poisoned bait—50 lbs. bran and 21 lbs. Paris green; bring to consistency of a stiff dough, adding water when necessary. Distribute this over the seed-beds in the forenoon, as the cutworm does most of its feeding at night. The beds should be thoroughly burnt over with wood or dry tobacco stalks to ensure that the seed-beds are free from cutworms, and baiting for any coming in from the surrounding ground should then be resorted to when the plants appear. Clear the ground for some distance round the beds, say 30 yards in all directions, and bait this ground thoroughly before sowing—this clearance allows a wide margin over which the cutworms would have to travel. Cutworms' moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night; this should be seen to each evening.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond-back moth and web-worm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans.—Planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus.—Throughout the month lime-sulphur spray (1-100) may be used to control yellow citrus thrip whilst on very young fruit. A useful spray against black aphis and thrip is the following:—Nicotine, 9 ozs.; Capex spreader, 7 ozs.; water, 100 gallons; Capex lime-sulphur, 1 gallon. This may be sprayed or fumigated against scale insects, having regard, however, to presence of fruit and blossom. Spraying and fumigating for scale should not be carried out whilst trees are in blossom. Clear young growth of aphis previous to blossoming, using nicotine, tobacco wash or Derris.

FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip and cabbage may be made now.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. Preliminary sowings of eucalypt seeds should now be made on a small scale, so that transplants will be ready in case the first half of the rainy season should prove favourable; otherwise, bulk sowings should be postponed to October-November.

GENERAL.

Indigenous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

The supply of green food to the birds must be kept up; in fact, during the hot weather they require more.

During our dry season the available supply of such green foods as lettuces, cabbages, sunflower leaves is much reduced, but there are many others that can be used, such as belhambra, plumbago, wild cockscomb, plantain leaves, paw-paw leaves, etc. Sprouted oats, barley and wheat should also be used. Many of the young cockerels should now be fit for killing. Keep the best and get rid of the remainder. It is very advisable to caponise all young cockerels when about 2½ lbs. weight. The "Rhodesia Agricultural Journal" of October, 1924, and Bulletin No. 517 give clear and concise details as to the method of performing the operation. Some of the earliest hatched young pullets will show signs of commencing to lay now. No light breed bird should lay until it is 5 to 5½ months old, or a heavy breed until it is 6 to 6½ months old. Should any show signs of commencing to lay before this, they should be moved from run to run to prevent their doing so. A bird that lays before it is fully matured will stop growing, will always be small, and its eggs will for its first year of laying also be small.

When the pullets are four months old, i.e., those of the light breeds, they should be put into their permanent laying quarters, and those of the heavy breeds when they are five months old. A bird that is moved after it has started to lay will stop and very probably go into a moult.

See that young ducklings get plenty of shade during the hot weather. Those destined for killing should not be allowed free range or even a medium-sized run, but should be kept fairly crowded in small runs. It is necessary to get the flesh on them as quickly as possible, and the more rest and less exercise they have, the more rapid will be the growth, and also more succulent and tender the flesh.

The hatching of turkeys should proceed rapidly and be carried on until the end of the dry season. See that they have plenty of chopped onions or onion tops or eschalots, and thick separated milk. These are absolutely necessary if the turkey breeder wishes to be successful with his rearing. Do not give wet food; dry mash such as given to chickens is the better.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary and seeing that they do not get too poor. The supplementary feeding of ranch stock is always a difficult problem. But a small provision of cotton seed, good veld hay, kaffir corn or sunflower silage at this time may be the means of saving many head of cattle when the rains are late. This is a critical month for young stock. Weaning should be completed as soon as conditions permit. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance. The object should be to build up the condition of the cows expected to calve when the rains come.

Sheep.—The remarks for August apply. Feed up and shear the rams ready for mating for winter lambs.

TOBACCO.

Hasten the preparation of seed-beds for flue cured type of tobacco. The first batch of beds should be seeded about mid-September; subsequent seeding of the remaining seed-beds should be done (in batches) at fortnightly intervals. The last lot of beds normally is sown by the end of October. Seed-beds for dark fire cured type of tobacco should be prepared for seeding which commences after the first week in October.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shows slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

October.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolic cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted.

On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs. Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stock require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize, crops planted late in October are liable to suffer in December from stalk-borer,

especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough by December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking or leaves will help to retain moisture and thus give further attraction, especially at this time of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of 1½ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," Sept., 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm ("Heliothis obsoleta").

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10 gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds

should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation. Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system, the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease" is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and cramp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheep-shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleaned out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds. Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

Southern Rhodesia Veterinary Report.

June, 1931.

AFRICAN COAST FEVER.

Melsetter District.—The mortality in the infected herds Tilbury Estate during the month was 124 head. It was decided to slaughter all the cattle involved, and at the end of the month 812 head had been disposed of.

FOOT AND MOUTH DISEASE.

Gwanda District.—An outbreak occurred at a native kraal on the east bank of the Umzingwane River, a few miles from its confluence with the Limpopo River. All cattle on this bank of the river between the Limpopo and the Mazunga Rivers were moved to the east of the Beit Bridge-Fort Victoria road. Fresh infection was reported at a native kraal about 60 miles east of Beit Bridge. On Liebigs Ranch several extensions of infection occurred.

Chibi District.—No fresh outbreaks in this district, and all previously infected areas appear to be cleared up.

Victoria District.—Several slight extensions of infection were reported. Infection has entirely disappeared from the majority of farms infected during April and May.

Ndanga.—An outbreak occurred at Bendazi on the Lundi River in the immediate vicinity of infection on the south bank of this river in Chibi district.

Chilimanzi District.—An outbreak occurred in the south-east corner of the Chilimanzi Reserve in the immediate vicinity of previous infection in the Victoria district. Two fresh outbreaks in the northern section of this district.

Charter District.—Nine fresh outbreaks. Most of the original centres of infection have cleared up. In a few instances sheep and pigs have contracted the disease.

Gwelo District.—Several fresh outbreaks in the immediate vicinity of previously infected herds.

Belingwe District.—The greater portion of the northern section of this district is now infected.

The type of this disease continues to be very mild, and the mortality negligible. For instance, in the Belingwe district, although about 25,000 cattle are involved, not a single death has been recorded.

TRYPANOSOMIASIS.

A slight mortality in cattle occurred in the Melsetter and Lomagundi districts.

SCAB.

Three outbreaks in sheep were dealt with.

QUARTER EVIL.

A few cases reported from the Umtali, Makoni and Marandellas districts.

IMPORTATIONS.

From the Union of South Africa: Bulls, 4; cows, 6; heifers, 16; horses, 37; mules, 10; donkeys, 32; sheep, 2,032; goats, 159.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

JULY, 1931.

Pressure.—The mean pressure for the month was uniformly low, roughly two millibars below normal.

Temperature.—Temperature was generally well above normal, with the exception of one or two stations. Mild frosts occurred at most stations.

Rainfall.—The usual winter showers were recorded in Zones B, E and F.

JULY, 1931.

Station.	Altitude Feet.	Pressure 8.30 a.m. Mb.	Temperature °F. Absolute. Max.	Temperature °F. Absolute. Min.	Temperature °F. Mean. Max.	Temperature °F. Mean. Min.	Temperature °F. Mean. ½ Max. Min.	Temperature °F. Diff. from Normal.	Humidity, 8.30 Wet Bulb.	Humidity, 8.30 %	Precipitation. Ins.	Precipitation. Diff. from Normal.	Precipitation. No. of Days.
Bulawayo ...	4,440	871.7	83	35	72.6	43.7	58.1	+1.1	48.5	60	...	...	...
Gwelo	4,632	865.9	82	36	71.1	44.5	57.8	+2.2	49.0	57	0.10	+0.1	1
Riverbank ...	4,100	...	86	30	78.9	43.4	61.1	+1.8	48.2	63	...	...	...
Essexvale ...	3,828	...	93	31	79.9	41.3	60 6	+3.2	45.9	82	0.09	...	3
Gwanda ...	3,235	910.8	86	34	73.6	44.6	59.1	...	57.0	61	0.14	+0.1	3
Mazunga ...	1,970	953.4	91	35	75.2	44.8	60.0	−2.0	52.5	65	0.91	+0.8	2
Nuanetsi ...	1,630	...	...	...	...	...	...	...	...	...	...	...	...
Between Rivers	3,970	...	87	36	80.4	39 3	59.8	...	47.2	72	...	...	...
Enkeldoorn ...	4,720	...	81	35	72.3	45.0	58.6	+1.8	49.7	64	0.07	...	2
Gatooma ...	3,850	...	83	38	76 0	43.5	59.7	−0.9	50.5	53	...	...	...
Miami	4,090	...	80	40	72.3	46.2	59 2	...	51.7	63	...	...	...
Salisbury ...	4,865	858.1	78	40	71.1	46.5	58.8	+2.5	49.1	63	...	...	...
Sinoia Citrus ...	3,830	...	83	28	74.6	40.7	57.6	...	50.1	72	...	...	...
Sipolilo... ...	3,900	...	80	40	72.5	47.2	59.8	...	51.9	54	...	...	...
Juliasdale ...	6,070	...	74	35	63.7	39 7	51.7	...	50.4	65	0.40	−0.5	3
Mtoko	4,210	...	79	44	71.5	49.6	60.5	...	53.2	66	...	...	...
Shamva ...	3,170	...	84	36	85 6	40.7	63.1	+3.5	53.1	77	...	...	...
Angus Ranch ...	2,300	...	85	42	74.5	49.9	62.2	...	52.3	75	0.35	+0.2	5
Craigendoran ...	3,000	...	87	39	75.9	46.8	61.3	...	54.0	78	...	−0.2	...
New Year's Gift	2,700	...	85	43	74.1	50.1	62.1	...	51.8	71	0.44	...	5
Nyamasanga ...	5,080	...	...	...	...	...	...	...	...	...	...	...	...
Riverdene North	3,700	...	86	29	74.3	40.2	57.2	+1.3	48.2	75	0.25	+0.1	6
Stapleford ...	5,450	...	72	30	60.6	39.2	49.9	...	49.2	81	0.49	−0.7	2
Umtali	3,677	897.0	83	41	72.1	50.7	61.4	+1.8	55.3	73	0.66	+0.4	3
Victoria ...	3,570	899.7	81	31	71.4	41.6	56.5	+1.2	48.2	68	0.16	+0.1	3
Melsetter ...	5,060	853.4	80	39	67.4	45.5	56 4	+1.2	51.0	63	0.48	−0.3	4
Mount Selinda	3,520	...	80	43	67.5	49.5	58.5	+1.2	54.6	77	1.55	...	7

Notes from the "Gazette."

"Gazette" Date.	Items.
	DAIRY INDUSTRY CONTROL ACT, 1931.
24.7.31.	The Dairy Industry Control Board, consisting of the following members, was established as from 24th July, 1931:—Official Member: E. R. Jacklin. Producers' Representatives: A. A. Draper, F E. Goodridge, W. E. Richards. Butter Manufacturers' Representatives: G. E. Straith, J. Buckmaster. Cheese Manufacturers' Representative: H. D. Rawson. Farm Butter-makers' Representative: H. P. Fynn.
	FOOT AND MOUTH DISEASE.
24.7.31.	(1) The movement of all cattle is prohibited within and from the areas described hereunder; provided, however, that special permits may be authorised by the District Veterinary Surgeon for the removal of cattle for meat supplies, local transport or other essential purposes.
	(2) The removal of all horses, mules, donkeys, sheep, goats and pigs from the areas described is prohibited, except under special permit by the District Veterinary Surgeon.
	(3) The removal of hides, skins, hay, forage and fodder within and from the areas described is also prohibited, except under special permit by the District Veterinary Surgeon and under such conditions as may be deemed necessary to impose.
	Description of Areas.
	(1) The native district of Mazoe.
	(2) That portion of the native district of Salisbury bounded on the east by and including the following farms: Oldbury, Zilisari Lots, Tudely, Pendennis, Outspan, Pomona, Pomona East, that portion of Borrowdale lying south of Lots 17 and "A," Colne Valley, Greendale south of Arcturus Road, Cleveland Dam Reserve, Donnybrook, Ventersburg, Adelaide, Glenwood, Arlington Estate, thence down Hunyani River to the border of the district. (G.N. No. 468.)
	FOOT AND MOUTH DISEASE.
7.8.31.	Similar restrictions to the above are imposed in regard to the following areas:—
	1. Insiza native district.
	2. That portion of the Umzingwane native district lying north-east of the Heany Junction-Gwanda railway line to the southern boundary of the Essexvale Estate and including the following farms: Heany Junction Farm, Napier's.
	3. That portion of the Bubi native district lying south of and including the following farms: Kennilworth, Crescens Bubi Block, Dollar Block, Inunwa Ranch, Loxley, Coombe Ranch, Courtleigh A and B, Redsdale, Dagmar, McCay's Ranch, McCay's Farm, Eastnor, Ventnor and Bardolphs.
	4. That portion of the Nyamandhlovu native district lying east of and including the following farms: Winter, Mararoa,

Esperanza, Cawston Block, Umguzaan Block, Seale, Mimoza Park Estate, Southcote, Reserve and Redbank.

5. That portion of Bulawayo native district lying east of the Bulawayo-Victoria Falls railway line and north of the Bulawayo-Salisbury railway line, excluding the Bulawayo Commonage.

(G.N. No. 505.)

WILD DOGS.

7.8.31. Government Notice No. 498 sets forth the procedure for claiming the reward of 10s. paid by the Government for the destruction of a wild dog and 5s. for a wild dog pup. Claimants for the reward can now fill in a form of certificate instead of the sworn declaration which necessitated the attachment of a 1s. stamp.

AFRICAN COAST FEVER.

Native District of Melsetter.

(a) Area of Infection.

24.7.31. The farms Welgelegen, Dunstan, Tilbury, Springfield, Rumble Rills, Tarka, Hayfield "A," Mermaids' Grotto and Forest Glade.

(b) Guard Area.

An area bounded by and including the following farms: Stonehenge, Vooruitzicht, Lindley, Melsetter Commonage, Greenmount, Orange Grove, Springvale, Bloemhoff, Ingorima Reserve, and thence along the Portuguese boundary to the first-named farm.

(G.N. No. 469.)

Sales.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (Blades), Algerian Variety: 20 slabs, 5s.; 50 slabs, 10s.; 100 slabs, 17s. 6d.

Stocks are limited, and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns: 10 crowns, 5s.; 20 crowns, 7s. 6d.; 50 crowns, 15s.; 100 crowns, 25s.

Delivery during September and October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December. The prices are for delivery free at purchaser's nearest station or siding in Southern Rhodesia. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 581. Leguminous Crops for Stock and Soil Improvement in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 603. The Production of Maize in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.
No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.
No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.
No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).
No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.
No. 724. Ploughing by Tractor, by A. W. V. Crawley, M.E., F.G.S.
No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
No. 750. Cotton in Southern Rhodesia—Hints to Growers, by G. S. Cameron, Empire Cotton Growing Corporation.
No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 757. Maize on the Sand Veld: Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.
No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.
No. 759. Witch Weed (Striga Lutea): Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
No. 777. Some Aspects of Cost of Production Studies in Agriculture, by Arthur G. Ruston, D.Sc., Department of Agriculture, Leeds University.
No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 783. Agricultural Costings at the Gwebi Farm—Fattening for Beef, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.
No. 794. Some Further Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.
No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

REPORTS ON CROP EXPERIMENTS.

No. 564. A Maize Rotation Experiment, by A. R. Morkel.
No. 566. Bulawayo Experiment Station, Annual Report for Year 1924-25, by H. G. Mundy, Dip.Agric., F.L.S.
No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.
No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.
No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.
No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.
No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.
No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
No. 767. Gwelo Municipal Demonstration Stations. Annual Report for the Season 1928-29, by D. E. McLoughlin.
No. 773. Bulawayo Municipal Demonstration Station: Report for the Seasons 1927-28 and 1928-29, by D. E. McLoughlin, Assistant Agriculturist.
No. 789. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, 1928-29, by H. C. Arnold, Manager.
No. 800. Bulawayo Municipal Experiment Station: Report for the Season 1929-30, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 806. Gwebi Demonstration Farm, by the Chief Agriculturist.
No. 810. Gwelo Municipal Demonstration Station: Annual Report, 1929-30, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

TOBACCO.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
No. 607. Tobacco Seed Beds, by D. D. Brown.
No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.
No. 617. Dark Fire-cured Tobacco, by E. M. Matthews, B.Sc., Tobacco Adviser. Fire-curing Tobacco Barn, by the Tobacco Advisers.
No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
No. 679. Tobacco Culture in Southern Rhodesia: The Harvesting and Curing of Virginia Tobacco, by D. D. Brown.
No. 689. The Lesser Tobacco Wireworms, by Rupert W. Jack, F.E.S.
No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.
No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.

No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.
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No. 771. Dark Fire-cured Tobacco: Field Operations, by D. D. Brown, Chief Tobacco Expert.
No. 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.
No. 779. Mycological Notes—Further Experiments on the Control of White Mould (Erysiphe Cichoracearum DC.) of Tobacco, 1927-28, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.Sc. (Agr.), Tobacco Adviser.

STATISTICS.

No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
No. 247. Statistical Returns of Crops Grown by Europeans in Southern Rhodesia for the Season 1915-16, by E. A. Nobbs, Ph.D., B.Sc., and Fred Eyles, F.L.S.
No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
No. 361. Statistics of Live Stock and Animal Produce for the Year 1919, by F. Eyles, F.L.S.
No. 380. Statistics of Crops Grown by Europeans in Southern Rhodesia, 1919-20, by H. C. K. Fynn.
No. 393. Statistics of Live Stock and Animal Produce for 1920, by H. C. K. Fynn.
No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1920-21, by H. C. K. Fynn.
No. 426. Statistics of Live Stock and Animal Products for the Year 1921, by H. C. K. Fynn.
No. 484. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1922-23, by A. Borradaile Bell.
No. 527. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1923-24, by A. Borradaile Bell.
No. 543. Statistics of Live Stock and Animal Products for the Year 1924, by A. Borradaile Bell.

LIVE STOCK.

DAIRYING.

No. 711. Dairy Buildings in Southern Rhodesia. A Small Farm Dairy, by B. G. Gundry, A.I.Mech.E.
No. 717. Gouda or Sweet Milk Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
No. 730. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.
No. 752. Cheese as an Article of Diet, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
No. 785. Bacon Curing on the Farm, by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
No. 792. The Feeding of Dairy Stock in Southern Rhodesia, by T. Hamilton, M.A., N.D.A., N.D.D., and J. R. Corry, B.Sc. (Agr.), Dairy Experts.
No. 799. The Objects of Ripening Cream for Butter-Making, and a few Hints on Cream Production, by F. Lammas, Dairy Officer.
No. 818. Farm Butter-making—Issued by the Dairy Branch.
Points to be observed in Cream Production.

VETERINARY.

No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
No. 536. Inoculation of Cattle against Redwater and Gall Sickness, by Ll. E. W. Bevan, M.R.C.V.S.
No. 570. The Spaying of Bovines, by G. C. Hooper Sharpe, M.C., M.R.C.V.S., and M. H. Kingcome, M.R.C.V.S.
No. 597. Suspected Poisoning of Stock: The Proper Procedure, by M. H. Kingcome, M.R.C.V.S. (Lond.), and A. W. Facer, B.A. (Oxon.), A.I.C.
No. 618. Notes from the Veterinary Laboratory: Quarter Evil, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
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No. 772. Notes from the Veterinary Laboratory: Ophthalmia, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.
No. 819. Measles in Swine, by P. D. Huston, M.R.C.V.S.
Services of Government Veterinary Surgeons.
The Campaign against African Coast Fever, by Ll. E. W. Bevan, M.R.C.V.S.
Parasitic Gastritis of Cattle, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

IRRIGATION.

No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.

No. 529. The Umtali River Irrigation Scheme, by C. P. Robinson, B.Sc.
No. 632. Domestic Water Supplies and Sanitation on the Farm, by P. H. Haviland, B.Sc. (Eng.).
No. 633. The Cost of Pumping for Irrigation, by R. H. Roberts, B.Sc. (Eng.).
No. 640. Levelling for Irrigation, by Dr. W. S. H. Cleghorne, M.I.Mech.E.
No. 659. The Hydraulic Ram, revised by P. H. Haviland, B.Sc.
No. 660. Small Earthen Storage Reservoirs, by C. L. Robertson, B.Sc.
No. 668. The Water Act, 1927, by C. L. Robertson, B.Sc. (Eng.), A.M.I.C.E.
No. 670. Irrigation Canals, by P. H. Haviland, B.Sc. (Eng.).
No. 735. Soil Erosion, by P. H. Haviland, B.Sc. (Eng.), A.M.I.C.E., Assistant Irrigation Engineer.
No. 766. Conditions Governing the Hire of Government Boring Machines.
No. 780. Short Specifications for Reinforced Brick Tanks up to 20,000 Gallons Capacity, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
No. 782. Reinforced Concrete Water Tanks, by R. Hamilton Roberts, B.Sc. (Eng.).
No. 786. Low Concrete Dams, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
No. 808. The Application of Water in Irrigation, by R. Hamilton Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.
No. 811. Irrigation Canal Structures, by R. H. Roberts, B.Sc. (Eng.), Assistant Irrigation Engineer.

FORESTRY.

No. 555. Forestry in the Melsetter District, by J. S. Henkel.
No. 575. Tending of Eucalyptus Plantations, by A. S. Thornewill, B.A.
No. 621. Forestry in Southern Rhodesia: The Raising of Plants from Cuttings, by A. S. Thornewill, B.A.
No. 722. Rules for Tree-planting, by T. L. Wilkinson, M.Sc., B.Sc.F.
No. 744. Farm Forest Practice in Southern Rhodesia; Part IV. Tending and Care of Young Plantations. Issued by the Forest Service.
No. 763. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.
No. 769. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.
No. 778. The Utilisation of Wood in Southern Rhodesia—Conversion and Disposal of Timber, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.
No. 791. The Utilisation of Wood in Southern Rhodesia: Fencing, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.
No. 809. Establishing Pines: Preliminary Observations on the Effects of Soil Inoculation. Issued by the Division of Forestry.
No. 817. The Raising of Forest Seedlings and Transplants on the Farm, by E. J. Kelly Edwards, M.A., Dip.For. (Oxon.), Acting Chief Forest Officer.
Price List of Forest Tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.
Matopo Nursery. Transplants for Sale.

HORTICULTURE.

No. 471. Budding of Citrus Trees, by A. G. Turner.
No. 637. Harvesting, Packing and Marketing of Deciduous and Tropical Fruits, by G. W. Marshall, Horticulturist.
No. 669. Citrus Fruit Growing in Rhodesia, by G. W. Marshall, Horticulturist.
No. 725. Investigations into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
No. 741. Fruit Growing in Southern Rhodesia: The Home Orchard, by G. W. Marshall, Horticulturist.
No. 805. Making a Garden in Rhodesia: Hints for Beginners and Newcomers, by Mrs. E. M. V. Carnegie.

No. 814. Avocado Growing in South Africa, by Redvers J. Blatt, B.Sc., Ph.D.
No. 821. Vegetable Growing in Southern Rhodesia—Lettuce, by G. W. Marshall, Horticulturist.
No. 824. Vegetable Growing in Southern Rhodesia—Tomato Culture, by G. W. Marshall, Horticulturist.
A Comparative Study of the Citrus Industry of South Africa, by Herbert J. Webber, Ph.D., D.Agr. Price 2s.

ENTOMOLOGY AND PLANT PATHOLOGY.

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No. 764. How to Make Use of the Fencing Law.

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Land Bank Act (price 1/-).

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Summary of the Game Laws of Southern Rhodesia

Opening of the Salisbury Show, 26th August, by His Excellency the Governor-General of the Union of South Africa (Earl of Clarendon).

[Courtesy of "Rhodesia Herald."

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Visit of His Excellency the Governor General.—Our frontispiece picture this month records the opening of the Salisbury Show by H.E. the Governor General of the Union of South Africa. This was the first visit of the Earl and the Countess of Clarendon to the Colony, and Rhodesians are pleased to think that the distinguished visitors saw much to interest them and carried away pleasant recollections of their sojourn in our midst. In the speech he delivered at the opening ceremony, His Excellency showed a wide appreciation of the difficulties which beset the agriculturist to-day, and his kindly sympathy will have a heartening effect upon those who are endeavouring to make a living on the land and those whose duty it is to advance the cause of agriculture in this distant part of His Majesty's possessions. A practical farmer himself, His Excellency emphasised the importance

of agricultural research in a young Colony such as this, and the strict application of its principles in farming. A visit to the display of the Department of Agriculture served to convince many of the truth of this statement and to apprise them of the numerous problems which await a solution before agriculture in Southern Rhodesia can be considered to be on a sound basis. His Excellency's remarks anent tobacco that quality is the best friend, whereas quantity may be the worst foe, bear a significance which should be taken particular note of at the present time.

Although by reason of the presence of foot and mouth disease there were no cattle on the show and the exhibits of our main agricultural products were few in number, His Excellency was able to form some idea of the possibilities and trend of agriculture in this Colony, and we sincerely hope that when he next pays us a visit, well-filled pens of fat stock and the usual array of high quality maize, tobacco and cotton, etc., will help to confirm the impressions he has already gained.

Publicity for Southern Rhodesia Tobacco.—Another opportunity of popularising and making known Rhodesian tobacco in the United Kingdom was afforded this Colony in July last when the new Empire Marketing Board's shop at Blackpool was placed at the disposal of the High Commissioner. Southern Rhodesia was in occupation for a period of fourteen days during the height of the season, when this popular Lancashire seaside resort is visited by hundreds of thousands of persons from all parts of the Kingdom. Judging from the Press notices received here and from photographs of the shop a most effective display was made. We learn that twenty-five different brands of cigarettes and forty-three brands of pipe mixtures manufactured from Rhodesian tobacco were on view and that a remarkable sale of samples were effected. Situated in a conspicuous position on the promenade the shop was visited daily by crowds of holiday-makers, who will, no doubt, carry to their homes the news that Southern Rhodesia can satisfy their wants for cigarettes and tobacco of high quality at a reasonable price. It is gratifying to learn that an appreciable increase in the

sales by retailers of Rhodesian tobaccos has been effected in Blackpool, and we trust that the results will be permanent.

It should be mentioned that the shop was opened formally by Mr. W. Lunn, Parliamentary Under-Secretary for the Dominions Affairs, in the presence of the High Commissioner, Hon. J. W. Downie, the Mayor of Blackpool and a large gathering. In the course of his speech Mr. Downie informed his hearers that the consumption of Rhodesian tobacco in the British Isles had increased from one million pounds weight in 1926 to six million pounds weight in 1931. That, however, he added, was only equal to four per cent. of the consumption in Great Britain, and they in Rhodesia were ambitious enough to set their goal at supplying forty per cent. of the total.

There is great scope here for a united effort.

A Step Forward.—It is gratifying to note that the tobacco growers of this Colony have closed their ranks and will henceforth meet common problems and difficulties with a united front. This has been accomplished by the decision taken at the annual general meeting of the Rhodesia Tobacco Association, held in Salisbury on the 11th September, to incorporate all interests in a new association to be called the Rhodesia Tobacco Planters' Association. According to the constitution of the new association, provision is made for representation of the Southern Rhodesia Tobacco Board, the Rhodesia Tobacco Warehouse and Export Co., Ltd., the Southern Rhodesia Turkish Tobacco Co-operative Society, the Southern Rhodesia Fire-Cured Tobacco Society, and representatives of all the tobacco producing districts. Thus every interest appears to be represented in the new organisation, which should be in a position to act with authority on all questions affecting the welfare and advancement of the tobacco growing industry of Southern Rhodesia. It is proposed to obtain the necessary funds to finance the association by a levy not exceeding one-tenth of a penny per pound on all tobacco exported or sold locally. Such a measure will require statutory authority, and negotiations are proceeding with the Government hereon.

We do not propose to publish any details of the constitution of the new association, as the rules and regulations have yet to be assented to by growers. It is sufficient at the moment to note that the growers at the meeting referred to agreed in principle with the re-organisation proposals submitted and approved of the imposition of a levy, provided a sufficient number of growers signify their willingness to pay the levy. In the meanwhile the old Rhodesia Tobacco Association will carry on and the executive remain in office until the new organisation actually comes into being.

We feel sure that all who have the interests of the tobacco growing industry at heart will welcome the formation of the new organisation, and we trust that it will be possible at an early date to give attention to the very important work awaiting consideration.

"How Tobacco is Exported and Sold to the Kingdom of Great Britain."—This is the title of an article which Mr. Hugh W. Taylor, late Tobacco Expert of this Department and now Associate Marketing Specialist of the Department of Agriculture, United States, has written for *Tobacco*, the American trade journal. The article is a lengthy and comprehensive one, and we cannot do more than refer to a few of the more salient points. The problem which Mr. Taylor is helping to solve is how best to maintain and extend the demand for American tobacco in Great Britain—America's best customer. He examines those conditions which operate against the present demand for American tobacco in the British Isles, and also the method of marketing tobacco in Great Britain, as well as the possibilities of improving America's position in this connection. Empire tobacco figures largely in Mr. Taylor's argument, and due notice is taken of the part played by Southern Rhodesia in supplying Great Britain's requirements. It is interesting to note that between 1907 and 1924 Great Britain had changed from a pipe smoking to a cigarette smoking country. In the last issue of the Journal we published data showing that in 1930 cigarette consumption in Great Britain accounted for seventy per cent. of the total consumption of tobacco. Mr. Taylor makes the point that although Empire tobaccos

have captured an increasing proportion of the tobacco trade of Great Britain, the increase has been in pipe tobacco, the consumption of which is declining. He considers that up to the year 1927, no substantial amount of the cigarette trade, which is increasing, had been diverted from American growths.

The position in this respect apparently had not altered materially in 1930, for in the article which appeared in the last issue of the Journal, Mr. Downie estimates that 90 per cent. of the Colonial tobacco manufactured in Great Britain in the year 1930 went into pipe smoking mixtures. The failure of Empire tobacco to replace American is not due, Mr. Taylor considers, to lack of apparently suitable tobacco nor to paucity of brands from which smokers could select, but to the peculiar natural flavour and aroma of the tobacco. These he considers are not objectionable, but are distinct and different from that of American tobacco. Another factor which operates against the increased consumption of Empire tobacco, pipe and cigarette, is the smaller margin of profit accruing to manufacturers and retailers from these types by reason of their lower selling price.

Mr. Taylor thinks that the difficulties being experienced by Empire tobacco growers are temporary, and will, no doubt, in time be overcome. "Packing can be improved to prevent loss through injury in transit, and cost of production can be reduced by changed methods of farming. The present obstacle of the peculiar flavour and aroma may, in time, change to a distinct advantage."

We have not the space to deal at further length with many other points of Mr. Taylor's interesting article, except to quote the following statement: "There is, then, no valid reason why with proper trade manipulation, Empire tobacco may not, in time, find favour with the cigarette smokers in Great Britain. If this should take place, the serious price differential between Empire pipe tobacco and cigarettes, and these products manufactured from American tobacco, would disappear and Empire producers would be at a distinct advantage."

The foregoing is evidently intended as a warning to American producers to be up and doing so as to meet further

possible Colonial encroachment in the British market. It should also serve as an incentive to tobacco producers in this Colony to see that the obstacles which are militating against the greater consumption of their leaf in the British Isles are overcome and no avenue left unexplored which will tend to place them on an equal footing with American competitors.

Ethics of Farming.—In these days of depressed prices for farming products and unrequited reward for labour it is difficult to appraise the life of the farmer. There is, however, one side of the picture which is often overlooked and which is very well expressed in the following words spoken by Professor Arthur J. Perkins, Director of Agriculture in South Australia, to a gathering of farmers in that State:—

"We should remind ourselves that farming, no more than engineering, teaching and other relatively ill-paid avocations, is not usually taken up for the sake of the profits it may promise, but rather as a means of earning a modest livelihood in congenial occupation. You are farmers, I take it, because you love farming, notwithstanding the hardships it occasionally entails. You love the scent of the turning sod, the willing work of a well-balanced team, the tender green of the newly-sprouted grain; and if you rise early and retire early, it is what Nature intended. Man should labour by the light of the sun; it is wild beasts only that roam about at night, seeking whom they might devour. There are very few of you who would exchange farming for any other occupation, notwithstanding the illusive glamor of cities, with their mansions and slums, their noisy crowds and lonely souls, their occasional "plums" and more frequent unemployment. In the city, when costs of production are not adequately balanced by selling prices, the manufacturer has no alternative but to shut up shop. Does that hold good in the country? I think not; and the thousands of farmers that are clinging to the land to-day is clear proof it."

In his concluding remarks Professor Perkins gives expression to a truism which present times have demonstrated very forcibly: "I shall say relatively to the present position of farmers that whilst at present prices they are certainly

not receiving adequate returns for their efforts and for the capital they are compelled to sink in their business, they have the satisfaction of knowing that they are not alone in this plight; and that those among them who have husbanded their resources in the past, and have not over-capitalised their farms on borrowed money, should be able to pull through, at the expense, it is true, of temporary reduction in their standard of living. A farmer has the advantage of a rent-free roof over his head; with ingenuity he can almost make his farm support him in foodstuffs; and facing, as we hope, an excellent season, he has good reason for optimism, notwithstanding unsatisfactory current prices for rural produce. There are, of course, some who are carrying a load of debt out of proportion to the producing value of their holdings, and to these I can offer nothing beyond the sincerest sympathy in their troubles."

If the present era of economic depression does no more than to bring home to all concerned in this Colony the evils of easy credit and over-capitalisation of farming propositions it will have served one good purpose.

Some Tobacco Items.—Great Britain is the greatest consumer per capita of cigarettes in Europe, and even exceeds the United States in this respect. According to *Tobacco*, the American trade journal, the per capita consumption of cigarettes in the United Kingdom in 1930 was 1,033, representing a steady increase yearly since 1926, when the figure was 824. The United States comes second with 998, followed by Czecho Slovakia with 835, Austria with 712, Germany with 508, Netherlands with 465, France with 435, Spain with 346 and Italy with 325. The Netherlands is the greatest consumer per capita of *all forms* of tobacco, with 6.27 lbs. per annum, the United States occupying second place with 5.84 lbs. Large numbers of cigars are smoked in the Netherlands, the per capita consumption in 1930 being 177.4. Germany accounted for 124.5 cigars per head and the United States for only 49.2. France was responsible for 6.5 cigars per person in 1930.

The stocks of American tobacco on hand at Liverpool on the 30th June, 1931, amounted to 137,037 hogsheads, of which 90,037 hogsheads were Virginia leaf and 41,018 hogsheads were Virginia strips. The total stocks of American tobacco on hand in the United Kingdom on 30th June, 1931, amounted to 203,046 hogsheads, compared with 188,663 hogsheads in 1930. A hogshead contains about 1,000 lbs. of tobacco. In the six months period 1st January to 30th June, 1931, the total quantity of American tobacco delivered to the United Kingdom was 47,459 hogsheads, as compared with 54,532 hogsheads in the similar period of last year and 58,997 hogsheads in 1929. Flue-cured prices in the United States of America in May, 1931, took an unprecedented fall to less than half of the May, 1929, value, and to approximately one-half that of May, 1930, the values being respectively 26.33, 23.34 and 12.26 dollars per hundred pounds. We notice from the monthly report of Messrs. Edwards, Goodwin & Co. for June, that American producers have been strongly advised to curtail their production until overseas markets became more stabilised.

It is interesting to note from *Tobacco* that "Rhodesian leaf is the most important of the British Colonial tobaccos, and in the six months period 1st January to 30th June, 1931, 6,560 bales and cases were imported into the United Kingdom." The Rhodesian bale contains approximately 200 lbs.

The following extract from the Marketing Report of the United States Department of Commerce, dated 16th June, 1931, has been forwarded to us by the High Commissioner and is published for general information:—

"*New Zealand.*—Increased import duties on tobacco and other recommendations were made by the Tobacco Industry Committee appointed under an order of the New Zealand House of Representatives to inquire into the tobacco-growing and tobacco-manufacturing industries of that country. The following are some of the recommendations submitted by the committee in its report:—

"For the purpose of safeguarding the revenue of the Dominion, the import duty on unmanufactured tobacco leaf should be 3s. per pound, or 260 per cent. *ad valorem*, whichever rate returns the higher duty. The present rate is 3s.

per pound. The report stated that the current domestic value as indicated on invoices at present is practically the same as the selling price to the purchaser. However, were this situation to change, if the above *ad valorem* rate is assessed, it would be on the invoice price and not on the current domestic price or value in every case including the statutory 10 per cent. added value.

"The import duty on cut tobacco n.e.i. should be increased from 4s. 2d. per pound to 5s. 6d., and the import duty on tobacco n.e.i., including the weight of every label, tag, or other attachment, to be 5s. 4d. per pound in place of the existing duty of 4s. The recommendation was also made that the fixed aggregate amount of combined customs and excise duties for these two items be abolished.

"The committee further recommended that the Tobacco Act of 1908 be amended so as to include definitions of 'fine-cut tobacco suitable for the manufacture of cigarettes' and 'unmanufactured tobacco,' suggesting for the former that the definition be 'any imported tobacco cut with 40 or more cuts to the inch' and that the latter should be defined as 'foreign leaf imported in strips.'

"Another recommendation is that in the future no drawback be payable on imported tobacco leaf once such leaf has been drawn for factory manufacture, but that drawback should remain payable on tobacco leaf damaged in transit or otherwise before drawn from bond. This recommendation would abolish the existing refund claimable on stalks, refuse, clippings or waste from imported tobacco leaf."

Food Investigation.—At the Imperial Research Conference held in October, 1927, it was decided that "Research Institutions of the Empire" should "be kept abreast of progress in preservation and transport of food," and the following method was recommended:—

(a) Each Research Institution of the Empire to forward all its publications on Preservation and Transport of Food to the Low Temperature Research Station of the Department of Scientific and Industrial Research at Cambridge.

(b) The Low Temperature Research Station to issue, from time to time, to the other Research Institutions of the Empire lists consisting of elaborated titles of useful publications.

We have received from the Department of Scientific and Industrial Research the fifth of these lists, which brings the period up to the 1st March, 1931. It contains sections dealing with meat, pig flesh, poultry and game, fish, eggs, dairy produce, fats and oils, fruit and vegetables, grain, crops and seeds, theory of canning, theory of freezing and chilling, bacteriology, mycology, engineering and miscellaneous, and constitutes a very comprehensive index to the literature on the subjects mentioned. The price of the index is 2s. net, and copies can be obtained from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C. 2, or from any of the agencies of the Central News Agency, Ltd., in South Africa.

Plant Breeding Abstracts.—The Imperial Bureau of Plant Genetics has begun to issue a publication entitled "Plant Breeding Abstracts," in which all the more important current publications dealing with plant breeding and the genetics of crop plants are listed. The references are classified according to subject, and each reference is followed by an abstract indicating the subject matter of the paper and the results obtained. The papers are divided into two halves, those published in the British Empire and those published in foreign countries. Papers written in foreign languages are usually abstracted somewhat more fully than papers in English. "Plant Breeding Abstracts" is issued quarterly, and Vol. 1, No. 3, which was published on 1st April, 1931, contains 197 references covering 52 pages. The annual subscription for the publication is at present 5s. post free, single copies being obtainable at the price of 1s. 6d. Subscriptions should be sent to the Deputy Director, Imperial Bureau of Plant Genetics, School of Agriculture, Cambridge, England.

Control Boards and their Functions.

By J. W. Downie, C.M.G., High Commissioner for Southern Rhodesia.

[*Attention is directed to the following article which has been written with the specific object of acquainting farmers with the functions of the various Dominion Control Boards and their operation in the United Kingdom. Since he has occupied his present office Mr. Downie has made a special study of this subject and has collected a great deal of information in the course of his enquiries. He has, however, for easy reference condensed his material into the following compass and in doing so gives a succinct but lucid exposition of the main facts of his enquiry.*

Changing economic conditions have induced Governments to adopt legislative measures to enable farmers to obtain a fair price for their products and instances in this Colony are the Maize Control Act and the Dairy Industry Control Act. These measures are on their trial and it is too early as yet to say whether the object for which they were conceived will be achieved. It is well that farmers should keep in close touch with the operations of "Control" measures elsewhere and Mr. Downie's timely article will, we feel sure, be a great help in this respect.—Ed.]

The changed world conditions of the last two decades has brought into existence a variety of schemes for meeting the new circumstances that have arisen.

The underlying purposes of all the schemes may be divided into two categories, one having for its purpose the restriction of production for the purposes of balancing supply with the needs of markets and thereby influencing prices for the immediate benefit of producers, the other having for its object the institution of what is now known as "Orderly Marketing" and all that those two words imply.

It is with the latter that the producers in Southern Rhodesia are most intimately concerned.

Without going into any great wealth of detail it may be stated thus: the United Kingdom is an all-the-year-round consumer in fairly even quantities and depends in increasing degree on overseas countries for that portion of its needs not provided by the United Kingdom producer. The overseas countries—and we are most concerned with Colonial Overseas countries—produce seasonally; they have what is commonly called a "flush" season when production is at a maximum tapering off as winter approaches to very small volume. The problem has been to reconcile erratic or irregular production with more steady demand and consumption.

An examination of the legislation of the firmly established exporting Colonial countries shows that where legislation has been introduced all countries follow on the same broad general lines, viz., grading for quality—not always meaning that only the best is shipped—storing where the need exists, handling at the ports, arranging bulk freight contracts, negotiating comprehensive insurance policies, regulating the flow of the commodity to the importing country so that there is neither shortage nor glut, inspection on arrival, maintaining close contacts with the agents and buyers and generally keeping the producer or supplier fully informed and acting in his best interests.

The best known examples of Control Board legislation are the New Zealand Meat Producers' Board, established by special Act of Parliament in 1921—this may be said to be the pattern on which all later Acts have been formed—the New Zealand Dairy Produce Control Board, 1923, New Zealand Honey, New Zealand Fruit (both 1924), the Australian Dairy Produce Control Boards, the South African Acts of more recent date and the less comprehensive controls

of some of the Canadian Provinces in relation to fruit. There does not appear to be any Canadian legislation relating to grain or dairy products of the New Zealand or Australian patterns.

All the Control Board legislation which has been examined and about which the appropriate Colonial Government and other officials established in London have been consulted deals with *export* only. None of the Boards exercises any authority over the internal trade of the products in which they are interested. In New Zealand and Canada there does not appear to be any interference. In certain Australian States there are various compulsory co-operation Acts. The same applies to the Union of South Africa.

The levy is common to most, if not all, the Control Acts.

The New Zealand Producers' Board is supported by a levy of twopence (2d.) per carcase of lamb or mutton, and one penny (1d.) per quarter on beef. With its funds it supports an organisation in New Zealand and in London, where its representative is well known and highly respected by the meat trade. He influences, but does not interfere. The Board expends £15,000 annually in publicity and display, mostly in meat trade shops. It is estimated that they place display material in some 25,000 shops, and this is independent of the publicity efforts of the Empire Marketing Board, of which he is a member.

The New Zealand Dairy Produce Control Board is supported by a levy of 1-32d. per lb. on butter and 1-16d. on cheese. The butter is graded in New Zealand by Government officials, the Board have freight contracts with three separate shipping lines, the butter is regulated in its shipment to the shippers' agents, there is no fixing of prices, though there is constant consultation. This Board also spends about £15,000 per annum in advertising and publicity.

New Zealand fruit pays a levy of 1½d. per case, and honey pays 1-16th pence. Both Boards provide publicity in accordance with their means. In the case of honey, Messrs. Mortons, the well-known packers, attend to the whole of the packing in small containers and to the distribution. The honey arrives in bulk and is prepared for sale retail by Messrs. Mortons.

Australian dairy produce is handled in much the same way. The representatives of the Board have their offices in Adelaide House on Thames side. They are in constant telegraphic communication with the Australian headquarters; they are kept advised of all shipments, and advise headquarters of United Kingdom stocks and sales weekly. The London representative is in daily touch with the importing members of the trade and is thereby enabled to keep both the producers and the buyers fully informed of day-to-day prices or stock movements. There is no difference between Australian and New Zealand methods deserving of mention.

The Australian producers (with some Commonwealth support) do a considerable amount of publicity on their own account quite independent of that done by the Australian High Commissioner's office or the different State agents' general offices, but always in complete understanding with them. Their methods extend to the opening of shops for short periods in selected towns, to cinema displays, to invitations to visit the shops and contact with both wholesale and retail establishments.

The New Zealand and Australian producers' organisations maintain very close touch with their respective Governments and in respect of exhibitions arranged by the High Commissioner's office; where official displays are made, the Control Boards contribute their share of the exhibition expenditure.

In so far as fruit is concerned, certain Australian States—and in the case of Canada at least one province—the provincial government officials receive the fruit and ship it to their Agents General in London, whose officials attend to the sale. In these instances the volume of trade is not yet sufficient to support independent organisations.

Sufficient has been written to permit Southern Rhodesian producers, and tobacco growers particularly, to determine whether and to what extent they can with advantage follow the example of other Colonial or Empire producers and interest themselves directly in the marketing of their produce in the United Kingdom and neighbouring countries. It only remains to add that Colonial marketing has succeeded in proportion to the use made of recognised and well-established trade organisations.

Revised Notes on Cotton Growing in Southern Rhodesia.

By G. S. Cameron.

At no time in the recent history of cotton growing in Southern Rhodesia has it been more difficult to write than at the moment. Having emerged from a season which has been fair in some areas and difficult in others, through long continued droughts, combined with bollworm attacks, the industry has received a check by the severe drop in prices which has recently occurred. Yet there are many farmers who agree with the writer that, bad as conditions have been, there is no justification for assuming that they will so remain.

For those who continue to take an interest in cotton growing as well as for those who, even in these times, may be induced to take it up afresh, the following revised notes are written in the light of experience gained during the past year.

Choice of Land.—It can safely be stated that cotton will grow on any good land in Southern Rhodesia, provided it is well drained and situated in areas where the rainfall will permit of early planting, that is to say, in November, though it should be remembered that crops at the higher altitudes run the risk of being checked by early frosts in certain years. Satisfactory cotton crops have been recorded on soils varying from white sand to rich chocolate loams. On the heavier soils, however, the crop takes longer to mature, and it is perhaps risky to attempt cotton growing on rich soil at a high altitude, except in seasons of early rainfall. Where there is a possibility of growing, say, ten bags of maize per acre, it might be better to grow that crop in preference to cotton. On otherwise good maize lands which, however, have become

worn out through continuous cropping, it would be worth while to give cotton a trial. By so doing it increases the yield of maize the following season, after which the land should be put under a green crop.

Fertiliser.—The fertiliser trials which have been conducted on the Cotton Breeding Station at Gatooma with surface application at time of planting do not show any appreciable increase in the yield of cotton as a result of fertilising. It does not follow that similar results would be obtained on different soils or on other areas, especially in sand veld areas, but there is not sufficient evidence to show that any known fertiliser treatment will definitely increase the yield per acre in Southern Rhodesia. In the meantime, therefore, we do not recommend the use of fertiliser, but would prefer to see it applied to other crops to be followed by cotton.

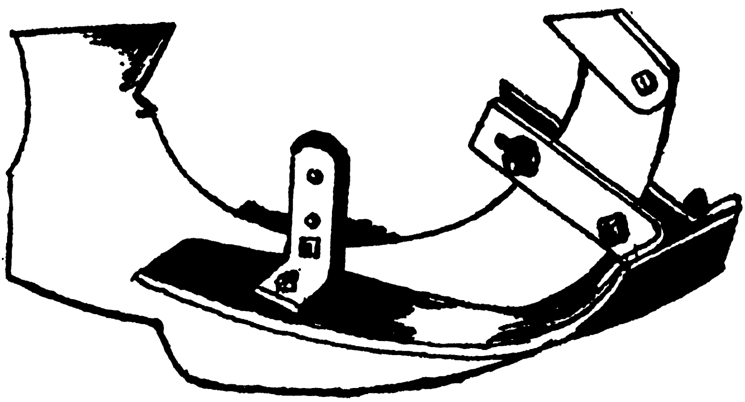
There appeared to be distinct evidence at Gatooma this year that cotton did better following a green manure crop (Sunn hemp) than following the other crops of the rotation. It is necessary, however, to remember that it was a season of long continued drought. It is felt that on heavy soils, and in a normal season, cotton might grow much too rank after a green manure crop.

Date of Sowing.—On general principles the earlier the cotton can be planted the better—that is, provided one can be reasonably sure of sufficient rains to carry the crop through the seedling stage and allow it to become established. Cotton planted towards the end of October or early in November should stand a very good chance of success in those areas where it is becoming an established crop. Even late planted cotton may pull through in seasons of light rainfall, but as it is impossible to forecast how the season will turn out, it is better not to take any unnecessary risks.

Planting.—Whether planting is carried out by hand or by machine, it is very necessary to use plenty of seed, as much of the cotton seed in Southern Rhodesia is affected by stainers, which reduce the germinating capacity. As there is now an unlimited supply of seed in the Colony, it is false economy to plant sparingly. For machine planting it would be as well to allow 25 to 30 lbs. of seed per acre. If planted

by hand, it would be advisable to plant six or seven seeds per hill.

The question of dry planting is one which each farmer has to settle for himself. If this method is adopted, there is a chance that light rains might germinate the seed, but not be sufficient to establish the plants, which would wither and die off. In such a case the cost of the seed plus the labour cost in planting would be the only loss. On the other hand, if the rains were sufficient to establish an early crop, the advantage of getting it so established would far outweigh any risk of having to re-plant. If dry planting is adopted,



it is well to remember that sufficient seed must be kept in reserve in case it is necessary to re-plant. It is generally advisable to plant cotton seed very shallow, so that it is covered by not more than about an inch of soil. When planting by machine, it is sometimes difficult to secure an even depth of planting owing to irregularities on the surface of the soil. In soft ground, or where there are numbers of small hillocks, the planter may go too deep, giving an uneven germination and consequently a bad stand.

This difficulty can be overcome by using depth regulators, which are attached to the runners of the planter. They consist of steel shoes, which can be easily fixed, as shown in the accompanying sketch. In addition to preventing the planter from going too deep into the land, the effect of the shoe passing over the soil tends to make a smooth track, in which the cotton seed is dropped.

The use of these attachments is strongly recommended. They are obtainable in Salisbury from various agricultural implement dealers, of whom particulars may be had from the writer.

Spacing.—Close spacing gives more plants per acre and does not leave so many blank spaces in the field after cutworms and white ants have taken their usual toll, and the experience of the past season has shown the great importance of a good stand. There are always a certain number of unavoidable casualties in every cotton field, and the more plants there are in it, within limits, to begin with, the better. Another advantage of close spacing is that it materially helps to set an early crop, which is of considerable benefit with the type of bollworm attack experienced during the last two years.

It was thought that the one outstanding disadvantage of close spacing would be in the event of a severe and prolonged drought that the closer spaced plants would then have to compete for the available moisture in the soil, and might suffer accordingly. In the ordinary routine of inspecting cotton crops this point was particularly observed. While the wider spaced plants did grow out slightly better, under drought conditions, plants at a reasonably close spacing gave satisfactory results and heavier final acreage yields.

There is, therefore, definite justification for recommending a close spacing of approximately six inches between plants in the row. Some farmers contend that such close spacing entails difficulty in hand-weeding. For those who are of this opinion, it is possible to plant at approximately twelve inches apart in the row, but leaving two plants per hill. Thinning-out operations should commence when the young plants have grown to a height of about four to six inches.

Cultivation.—The oftener cotton can be cultivated in the earlier stages the better. As soon as the young seedlings are through the ground, so that the rows are distinctly visible, they should receive their first cultivation. The number of times cotton should be cultivated depends on the amount of weeds in the crop. As a general rule it is necessary to put the cultivators through about four to six times. If weeds persist, it would be better to abandon part of the

crop and concentrate only on as much as can be kept clean. It is useless to expect a good yield of cotton if the crop is choked with weeds.

Stainer Traps.—About the end of February, or as soon as stainers commence to make their appearance in the cotton fields, attempts should be made to keep them in check as far as possible. This is done on the Cotton Breeding Station at Gatooma, where the procedure adopted is as follows:—About fifteen traps per acre are placed under cotton bushes. The trap consists of a double handful of old cotton seed, which is first of all soaked in water. By putting the trap on the ground under the cotton plant it gets the benefit of shade, which helps to keep it moist. The trap acts as a bait for the early broods of stainers, which collect on the moist seeds and lay their eggs. After the first day or so a boy should be sent round to collect the stainers, to destroy the stainer broods, and at the same time, if necessary, moisten the traps with water. When the seed in the traps has germinated, the traps become unattractive, and fresh seed must be set. The seed from the disused traps should be collected and destroyed. At the same time that the boy is going from trap to trap he can collect any casual stainers he may see on his journey.

Once the first bolls begin to open the traps lose their effect, as stainers prefer to collect in the early opened bolls. Trapping should then be discontinued. The chief point in favour of the traps is that they help to keep stainers off the young unopened bolls, which otherwise they would puncture and destroy.

The main drawback to trapping seems to be its simplicity. It often happens that when the system is recommended one is immediately met with suggestions for improvement, such as poisoning the traps or using some contrivance to kill the stainers while on the trap. Many of the suggestions have been tried out, but so far the simple method of collecting mentioned above has proved best. The cost is not great. Actually it works out at about one boy to about 40 acres for a period of about two or three months. If the crop promises to be a good one, it is surely worth endeavouring to save as much of it as possible from stainer damage.

The benefit derived from stainer trapping on the Cotton Breeding Station and the superiority in the germinating quality of the seed have been so marked that it is now considered advisable to recommend that the system be put into general practice.

Picking.—In an ordinary year cotton should be ready for picking in about six months from date of planting. There is no hard and fast rule as to when cotton should be reaped, but it is well to remember that the longer the cotton is left on the plant, within limits, the easier it will be for the labourers to bring in a fair amount of seed cotton per day. It is difficult to define what constitutes a fair amount of seed cotton for a boy to pick. At present the native labour of the Colony is not sufficiently experienced in picking cotton to be able to gather a large daily amount. On a good, well-opened field of cotton an experienced picker will bring in as much as 100 lbs. of seed cotton per day. To begin with, it would be better to set a much lower standard in this Colony until natives become accustomed to the work, and growers should be satisfied with 40 to 60 lbs. per picker on a good crop.

Sorting.—Pickers should be gradually trained to pick only the white unstained cotton in the field. Stained and dirty cotton should be left on the plant until the end of the season, when a final clean-up of all the cotton in the field can be made. Even in the best fields, however, there will always be a certain amount of stained cotton, and this should be picked out when baling the seed cotton for despatch to the ginnery. Too much time should not be wasted on this operation, as there ought not to be much stained cotton to be sorted out if the pickers have been trained to do the work properly.

Issue of Special Seed from the Cotton Breeding Station, Gatooma.—New sub-strains of U. 4 are being bred up which appear increasingly suited to the conditions of the Colony; they are yielding well and are producing lint of good quality and uniformity. But it is only after trial over a number of seasons, and throughout the Colony, that the relative merits can be judged and a general issue be made with confidence. It is not proposed, therefore, to issue special packets of

selected cotton seed in the ordinary way this year as has been done formerly.

Ratooning.—Probably one of the most debated questions in connection with cotton in any new cotton growing country is that of ratooning. The practice is one which has many advocates, yet it is one which, as far as the writer is aware, rarely becomes firmly established. That does not mean that under new conditions it should not be fully investigated wherever possible, provided that by so doing the whole question is approached with a perfectly open mind and without jumping too hastily to definite conclusions.

It may be remembered that six years ago there were many who strongly argued in favour of ratooning, but in spite of the enthusiasm then displayed, the practice never became general. True, there were a number of successes, but it was found that ratooned cotton proved just as susceptible to jassid as did the annual cotton. Now that there has been a renewed interest in cotton growing due to the discovery of suitable jassid-resistant strains, the question of ratooning appears to have again come to the fore. Whether it is going to prove more successful with U. 4 cotton and its derivatives than it did with the Improved Bancroft variety previously grown, remains to be seen.

It may be that in certain of the colder areas in Southern Rhodesia ratooned cotton will offer possibilities, as it matures much earlier than annual cotton. There is a danger, however, of its being too early, with consequent boll opening in the rainy season. By cutting back the plants early in December it may be possible to delay the crop sufficiently to prevent the bolls opening before the end of April, and if this can be done there would appear to be certain advantages in ratooning.

One of the chief disadvantages of the practice is that it attracts insect pests much earlier than the annual cotton, and breeds them up to such an extent that the latter is literally bombarded with bollworms and stainers to a greater extent than otherwise would be the case. This means that annual cotton grown close to or in the vicinity of ratooned cotton does not get a fair chance, yet the statement is fre-

quently made that annual cotton gives very poor yields compared with ratooned cotton grown alongside it.

A few good ratooned crops were obtained last season, and we may therefore expect a considerable increase this coming year. In discussing the matter with advocates of the practice, they readily admit the danger to their annual cotton, which, however, they frankly state they are willing to sacrifice in order to obtain what they consider the more certain returns from their ratooned crop.

Emphasis must be laid on the fact that the few successes mentioned were obtained in years of severe or partial drought, and it would be unwise to assume that similar results will be obtained every year. Probably the chief advantage in ratooning is that it saves cost of ploughing and preparing the soil as well as the minor cost of seed. Even this is a consideration in times like the present. The writer is not sufficiently conversant with the practice to say more about it than has been indicated above, but for those who wish to try it there may be no harm in experimenting with a moderate-sized plot or field, provided there is no annual cotton nearby. As with annual cotton, it has to be kept clean from the beginning of the season, so that in this respect there is not much saving in cost of labour.

Mycological Notes.

CARE OF TOBACCO SEED-BEDS.

By J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.,
Plant Pathologist.

In September and the previous month's issues of the *Rhodesia Agricultural Journal*, the Tobacco and Cotton Expert has described the methods recommended in this Colony for the preparation of tobacco seed-beds in order to produce strong, healthy seedlings for transplanting. Since a great many troubles arise from the imperfect execution of routine operations in the seed-beds, it is proposed to deal with them in detail and to point out just where the grower is liable to "slip up" in these early and very important stages of tobacco culture.

It is now generally recognised that, before sowing, a thorough cleansing and disinfection of the seed is necessary in order to ensure good germination and the elimination of the two bacterial diseases—Angular Spot and Wildfire. The method of treating seed with nitrate of silver was fully described in this Journal in 1929 (1), and last season full instructions were given for the preparation of Bordeaux Mixture (2). The two diseases, angular spot and wildfire, together with their control measures, have also been fully described (3), so that this article will deal almost exclusively with the diseases occurring in seed-beds which are not due to parasitic organisms and which are, incidentally, more frequently encountered.

When the seed has been treated, washed and thoroughly dried, it should be placed in a bag or screw-top jar which has not contained untreated seed or other tobacco refuse.

Great care must be exercised after disinfection to ensure the exclusion of anything which may have been in contact with tobacco; even the hands should be washed before touching treated seed if contaminated material has recently been handled. For those who use the watering-can method, it is a good plan to do the treatment immediately prior to sowing, when the necessity for drying and storing is obviated. Do not, however, carry out the operation near seed beds.

Silver nitrate will cause a brown stain upon the hands, but this can easily be removed with pumice-stone or similar material, and is quite harmless.

Remember that seed treatment of tobacco is aimed at destroying the bacteria of angular spot and wildfire, which are carried on the seed coat. It does not do away with the necessity for eliminating mosaic plants directly they appear, nor will it lessen the attack by white mould if adequate priming is not carried out.

Diseases due to Improper Watering.—After the seed has been sown, strict attention should be given to watering. Too much or irregular watering is as inadvisable as insufficient watering. In the dry season, when hot winds are blowing and evaporation is very rapid, it is found that at least three applications of water per day are necessary to prevent the seed-beds from drying out, and it is better to apply three light waterings per day rather than to give heavy waterings in the morning and evening only. In order to conserve the moisture as much as possible, a layer of grass should be put down on the surface of the soil and not removed until the young plants are well in evidence, thus forming a protection from the drying winds; a double layer of cheese-cloth or a raised glass shade are also employed in this connection. It is at this stage that the conservation of moisture in the beds is found to be most difficult. If an excess of water is applied, so that the soil is constantly very wet, the evaporation induced by the hot winds so lowers the temperature of the soil that germination of the seeds or the growth of young plants are considerably retarded, and it is the writer's opinion that many of the complaints which are made about the effects of seed treatment are founded upon faulty watering of the beds. Irregular watering is often the cause of

the death of small plants, because, after the seed has germinated, the young seedlings have no reserve moisture to sustain them other than what they are capable of absorbing from the soil. Young tobacco seed does not contain a large food reserve capable of absorbing moisture which may be drawn upon by the young plant, so that if the seed has once been stimulated to germinate and the surface of the seed bed is allowed to become dry, then the minute seedling will wilt and die. It can thus be seen that retarded germination of the seed or death of young seedlings may be directly due to either excessive or irregular watering.

Other troubles arising from improper watering are also confused with parasitic diseases, the principal symptoms being divided into three classes, viz.: (1) Bare patches and uneven growth throughout the whole bed; (2) plants dying off at one end of the bed; and (3) plants only growing at the base of the stakes supporting the cheese-cloth wire and in two parallel lines running midway between the centre and the borders.

Symptom (1) may generally be attributed to insufficient or excessive watering or uneven sowing, and the remedial measures are obvious.

Symptom (2).—On examination it is almost invariably found that the diseased end of the bed is the more remote from the source of water supply, and the explanation for the condition is that labourers empty their cans before completely watering a bed, return to refill the cans, do not go back to the place where they originally stopped, but prefer to start on a new bed. More careful supervision of labour is undoubtedly called for in this case.

Symptom (3), though not occurring as frequently as the former, has been observed on several occasions. It is the result of watering the beds without removing the cheese-cloth. The water does not penetrate the material evenly, but runs down to the lowest point of the sag in the cloth, and from there drops to the soil. A certain amount of water also flows down the stakes supporting the wire, but the remainder of the bed remains dry. It is only in the limited areas which receive water that the seedlings are capable of growing, all plants in the dry patches dying off.

Disease, therefore, which is often erroneously attributed to inferior seed, is solely the result of insufficient supervision of the operation of watering. As will be explained, "damping-off" is favoured by too humid conditions: it is also apparent that young plants are easily killed by arid conditions. It is essential, therefore, that strict European supervision of all seed-beds be established if healthy seedlings are to be raised.

Diseases due to Improper Soil Treatment.—Irregularity in growth may arise from a variety of sources unconnected with parasitic diseases. Over-burning is a frequent cause of soil sterility, and the germinating seedling is unable to obtain a sufficient supply of food material to enable it to grow; but, on the other hand, if the beds are subjected to the correct amount of heat, then the fertility of the soil is increased, because certain organisms which parasitise the nitrifying bacteria are killed, while the bacteria remain unharmed and are enabled to develop at a much greater rate, thus increasing the nitrate content of the seed-beds.

Lack of drainage is another source of irregular growth. If the soil contains an excess of stagnant water, the roots of the young plants are suffocated, so that it is only in parts of the bed where drier conditions exist that good growth can take place.

Uneven distribution of fertiliser or the use of the wrong kind of fertiliser should be studiously avoided. Unless nitrogen in a form readily available to the young plant is present, normal development cannot take place. The presence of inorganic nitrogen in the soil solution is of primary importance for plant growth.

A further cause of irregularity in the plants is the presence of an excessive quantity of wood ash. Wood ash contains a high percentage of potash, and if the concentration of this is too great the delicate roots of the young seedlings are inevitably subjected to a physiological burning.

Bruising and Burning of Leaves.—Apart from irregularity in growth, certain damage may be done to the tender leaves by agencies which do not appear to be fully understood by the average grower. Large brown lesions or dark green blotches may be caused by the action of the wind or

by the careless handling of the cheese-cloth by labourers. Scorching of the leaf soon after removal of the cheese-cloth is frequently the result of excess of nitrogen in the soil; this type of scorch may be distinguished by its occurrence on plants which are of a very dark green colour, and should not be confused with the light brown shrivelling known as "fertiliser burn," which develops when nitrate of soda solution of too high a concentration has been watered on to backward plants.

Brown lesions on the leaves cannot be considered as true symptoms of any particular disease, but are due to the death of the cells in the affected area. That a disease is infectious is usually indicated by its spread in the seed-beds, and every precaution should be taken at the earliest opportunity to deal with the outbreak. Damage which is confined to isolated patches can, however, usually be looked upon as non-infectious, and the origin should be sought in the routine of the farm.

Diseases due to Unbalanced Nitrogen.—The maintenance of a correct nitrogen balance in the plant is of great importance in the growing of tobacco, excess or deficiency of this element being at once obvious to the experienced farmer. It is an all too common sight to see chlorotic plants in the seed-beds, their presence being due to an insufficient supply of inorganic nitrogen in the soil, but sometimes the reverse condition is met with, when the young plants are seen to have leaves of a very dark, bluish-green colour and stems which are larger than normal, soft and "sappy." When the cheese-cloth or other shade is raised, these plants become easily scorched by the sun's heat and develop large brown blotches on the leaves. In extreme cases considerable damage may result.

The remedy for nitrogen deficiency in the seed beds is the application of quickly available nitrogenous fertilisers such as nitrate of soda or liquid chicken manure, but great care must be taken to see that the solutions are not too strong, or the plants too small, otherwise severe burning will result. Nitrate of soda should be applied by watering on a solution not stronger than 1 lb. to 8 gallons of water (i.e., ½ lb. per petrol tin), and the plants should have leaves as large as a shilling. If, however, it is found that the seedlings are not making good growth soon after germination

and that there is a danger of losing them, then the solution may be diluted four times (i.e., ½ lb. of nitrate of soda to four petrol tins) and watered on for four days in succession. Eight gallons of the solution should be sufficient to cover 20 square yards of bed.

Immediately after the application of these forcing fertilisers the beds should be watered in order to remove the solution from the tender leaves, which will otherwise be severely scorched, whilst it is also important to perform these operations in the late afternoon in order to avoid burning by the sun.

Excess of nitrogen in the seed-beds cannot be overcome, so that care should be taken to see that the correct amount of fertiliser is applied when the beds are being prepared.

Fungus Diseases Confined to Seed-Beds.—"Damping-off" of seedlings is a universal disease of most cultivated plants, and is caused by a number of fungi which normally inhabit the soil. In Southern Rhodesia, however, the only "damping-off" fungus which has so far been observed on tobacco is *Rhizoctonia solani* Kühn, which appears to be present in all localities. It is known that this fungus does not normally attack growing plants, but usually obtains its food material from the soil, through which it ramifies, forming a network of very fine threads; it only becomes actively parasitic when brought in contact with young plants which, for some reason or other, are not growing vigorously. The universal presence of this fungus in our soils is one of the principal reasons which necessitates sterilisation by heat as a preliminary to tobacco growing.

Description.—The fungus attacks young plants at soil level and penetrates the tender stalk, causing a brown lesion which gradually extends through the tissues and eventually girdles the stem. Seedlings so affected begin to wilt and very soon collapse, when they appear as a light, fawn-coloured mat upon the surface of the soil.

The disease usually appears on various parts of the seed-bed and spreads outwards in all directions from the place of origin. The dead patches of affected plants are therefore circular in shape, but may run together to cover a considerable area if the points of infection are situated close together.

Conditions Favouring the Disease.—Conditions which bring about "damping-off" are an excess of soil moisture in

conjunction with weakly plants, and it has been noticed that the disease spreads very rapidly in infected seed-beds at the time of year when heavy dews are experienced at night-time.

Control.—The control of the disease is simple if taken in time. Watering should be cut down to a minimum and cheese-cloths raised, in order to aerate the beds as much as possible. Usually it is found that such operations will permanently check its further spreading, but in particularly severe cases the diseased patch and a narrow margin of healthy plants should be drenched with a solution of commercial formalin (1 part to 25 parts water). The cheese-cloth must be kept raised, and not lowered until all the fumes from the formalin have been dispelled, otherwise there is a distinct danger of poisoning the healthy seedlings.

Pink Mould (*Pyronema omphalodes* (Bull.) Fckl.).—A fungus which has caused considerable consternation amongst growers is what is known as pink mould. Pink jelly-like masses, which are the fruit bodies of the fungus, appear upon the ground and occasionally seem to smother young seedlings. This organism has never been recorded as a parasite, but feeds upon non-living matter, its favourite habitat being burnt ground or charred wood. It is commonly seen after grass fires which have been followed by a period of wet weather. The presence of pink mould is often put forward as an argument against the burning of seed-beds, but there is no evidence to show that any damage is caused by the fungus; in fact, its presence is merely an indication that excessively damp conditions exist.

Other Diseases Occurring in Seed Beds.—"Damping-off" and pink mould are the only diseases which have been found to be peculiar to seed-beds, although occasionally very young plants which have been allowed to become dry are attacked by the fungus *Alternaria tenuis* Nees and killed; but this is no true indication of the parasitism of the organism, which generally occurs in Southern Rhodesia as a saprophyte, or very weak parasite, invading the lesions caused by physiological or virus diseases. Certain very important diseases of the field crop are known to appear in the seed-beds, at which stage every effort should be made to eradicate them. Wildfire and angular spot have been known for some years

to make their appearance in seed-beds, and it is generally thought, at least in Southern Rhodesia, that this rule is almost invariable. In the last few years the fact has been brought home to farmers that mosaic is also found in young plants before transplanting, whilst more recently still the writer (4) has drawn attention to the occurrence of frog eye on chlorotic seedlings. A further fungus disease to which little attention has been paid in the past is that caused by *Phyllosticta nicotiana* Ell. and Ev. Sometimes an appreciable amount of damage is done in the field by this disease, and it has been traced to the seed-beds, where it may be the cause of the death of backward plants. It is not certain how infection is brought in all cases to the beds, and although it is known that bacteria are carried on the seed, and it is suspected that one fungus may be, yet there is every reason to believe that organisms make their way to the plants from outside sources, such as old tobacco trash, and it is against such infection that spraying with Bordeaux mixture is recommended.

In conclusion, it must be stated that next to seed treatment and Bordeaux spraying, in order of importance of seed-bed operations, is the eradication of mosaic-infected seedlings augmented by the use of disinfectant solutions in which labourers wash their hands before commencing work.

For a full consideration of diseases of tobacco in Southern Rhodesia, reference should be made to the present writer's recently published handbook which can be obtained from the Accountant, Department of Agriculture, Salisbury, price 3/-, or 3/6 post free.

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Tobacco Experiment Station, Salisbury.

REPORT OF GENERAL CROP EXPERIMENTS.

By C. A. Kelsey Harvey, Manager.

Owing to the reorganisation of the work to be carried out on this station, as a result of it being made the principal centre for tobacco research, a number of experiments of a more general nature will unavoidably have to be discontinued. Many of these investigations have not yet had time to afford data from which definite conclusions can be drawn, but the details available are published here, firstly, in order to place them on record, and secondly, in the belief that they afford useful guidance in many of the problems which confront the sand veld farmer.

Crop Rotations on Sand Veld.—Certain rotation experiments have been carried out on this station over the past five years, and the following tables afford details of these and the results so far obtained. Tobacco being the principal crop on the type of soil represented, most of the rotations were designed with this as the major crop.

Rotation A, consisting of tobacco, tobacco, ground nuts, velvet beans ploughed under on light, sandy soil:—

Year.	Rainfall inches.	Crop.	Fertiliser per acre.	Average yield per acre.
1st	46.4	Hickory Pryor tobacco	Complete tobacco fertiliser, at 200 lbs. per acre	592 lbs.
2nd	38.52	Ditto	160 lbs. blood meal	611 lbs.
3rd	20.44	Ground nuts (Spanish Bunch)	Nil	11.96 bags
4th	24.70	Velvet beans ploughed under	Nil	—
5th	27.32	Tobacco (Hickory Pryor)	Complete tobacco fertiliser, 200 lbs. per acre	683 lbs.

Rotation B, consisting of tobacco, tobacco, maize, velvet beans ploughed under on similar soil:—

Year.	Rainfall inches.	Crop.	Fertiliser per acre.	Average yield per acre.
1st	46.4	Tobacco, Hickory Pryor	Complete tobacco fertiliser, 200 lbs. per acre	586 lbs.
2nd	38.52	Ditto	160 lbs. blood meal	641 lbs.
3rd	20.44	Maize	Nil	6.75 bags
4th	24.70	Velvet beans ploughed under	Nil	—
5th	27.32	Tobacco, Hickory Pryor	Complete tobacco fertiliser, 200 lbs. per acre	619 lbs.

The ground nut and maize crops which followed the tobacco in the third year of the rotation gave poor yields, but this was partially due to the lack of rain that season. Subsequent experiments have shown that the yield can be considerably increased by the direct addition of 150 lbs. of bone and superphosphate per acre to maize following tobacco in the rotation. It will be noted that in both rotations the yield of tobacco has been well maintained in the fifth year.

Rotation C (1), consisting of tobacco, green manure, tobacco, green manure, maize, on poor grey sandy soil:—

Year.	Rainfall inches.	Crop.	Yield per acre.
1st	46.4	Hickory Pryor tobacco + 200 lbs. double complete fertiliser per acre	375½ lbs.
2nd	38.52	Velvet beans ploughed under	—
3rd	20.44	Hickory Pryor tobacco + 200 lbs. double complete fertiliser per acre	987 lbs.
4th	24.70	Velvet beans ploughed under	—
5th	27.32	Maize + 150 lbs. bone and supers. per acre	12.56 bags

Rotation C (2).—Green manuring for tobacco in alternate seasons on poor grey sandy soil:—

Year.	Rainfall inches.	Crop.	Fertiliser per acre.	Yield of crop per acre.
1st	46.4	Tobacco, Hickory Pryor	160 lbs. double complete fertiliser (7.20.10)	338½ lbs
2nd	38.52	Kaffir beans ploughed under	—	—
3rd	20.44	Tobacco	160 lbs. blood meal fertiliser	764 lbs.
4th	24.70	Velvet beans ploughed under	—	—
5th	27.32	Tobacco	160 lbs. double complete tobacco fertiliser	847 lbs.

Rotation C (3).—Green manuring for tobacco in alternate seasons on poor grey sandy soil:—

Year.	Rainfall inches.	Crop.	Fertiliser per acre.	Yield of crop per acre.
1st	46.4	Tobacco, Hickory Pryor	160 lbs. double complete tobacco fertiliser (7.20.10)	337 lbs.
2nd	38.52	Niger oil (reaped)	Stubble only ploughed in	—
3rd	20.44	Tobacco, Hickory Pryor	160 lbs. blood meal (6.18.8)	596 lbs.
4th	24.70	Velvet beans	—	—
5th	27.32	Tobacco, Hickory Pryor	200 lbs. double complete tobacco fertiliser (7.20.10)	827 lbs.

Rotation C (4).—Tobacco followed by a grass crop for hay, followed by a leguminous green manure in alternate seasons, on poor, grey sandy soil:—

Year.	Rainfall inches	Crop.	Yield per acre.	Remarks.
1st	46.4	Tobacco + 200 lbs. double complete fertiliser per acre	366 lbs.	—
2nd	38.52	Sudan grass for hay	2 tons hay	—
3rd	20.44	Tobacco + 200 lbs. double complete fertiliser per acre	418 lbs.	Poor yield of tobacco after Sudan grass
4th	24.70	Velvet beans ploughed under	—	—
5th	27.32	Tobacco + 200 lbs. double complete fertiliser per acre	545 lbs.	Increased yield over 1st and 3rd years' tobacco

Reference to rotations C (1), C (2), C (3) and C (4) indicates the benefit of a green manuring to the following tobacco crop. A useful comparison may be drawn between rotations C (2) and C (3) with C (4), where the tobacco follows a niger oil crop reaped. It will also be noted that in C (5) the yield in the fifth year, after velvet beans ploughed under, is 127 lbs. per acre heavier than after the stubble of Sudan grass ploughed under. In all cases the tobacco grown after green manure crops on this light sandy soil was of good commercial quality.

Rotation A (1).—Four tobacco crops on the same land in six years on grey sandy soil:—

Fig. 1.
Maize and tobacco after green manure Tobacco Experiment Station, Salisbury.

Fig. 2.
Kaffir beans broadcasted between the rows of maize at the rate of 40 lbs. per acre at the time of the last cultivation. The maize has been topped for silage to allow more light to the underplanted crop to obtain maximum growth for ploughing under.—Tobacco Experiment Station, Salisbury.

Year.	Rainfall inches.	Crop.	Yield per acre.	Analysis of Grades.					
				Bright.	Medium Bright.	Medium.	Dark.	Green	Perished.
1925-26	38.52	Tobacco + 200 lbs. per acre commercial tobacco fertiliser	638 lbs.	—	—	—	—	—	—
1926-27	20.44	Tobacco + 200 lbs. per acre commercial fertiliser	1,082 lbs.	—	—	—	—	—	—
1927-28	24.7	Ground nuts	16 bags	—	—	—	—	—	—
1928-29	27.32	Velvet beans ploughed under	—	—	—	—	—	—	—
1929-30	21.45	Tobacco + 200 lbs. per acre double complete tobacco fertiliser before planting + 50 lbs. after planting	1,185 bags	3	10	53	29	5	—
1930-31	28.67	Tobacco + 200 lbs. per acre double complete tobacco fertiliser	662 lbs.	12	14	38	10	13	13

It will be noted that in the above rotation two tobacco crops are followed by two legumes (i.e., ground nuts reaped and velvet beans ploughed under). Analysis of the 1929-30 crop shows a predominance of medium grades, while the 1930-31 crop shows a higher percentage of bright and medium bright leaf, but with 13 per cent. of badly-perished leaf. This is not a system of cropping recommended for adoption.

Rotation S (1) on light pink contact soil. This consists of a six-course rotation without tobacco, designed to meet the needs of stock and mixed farmers on the sand veld.

The rotation provides that one-third of the land is under fertilised maize underplanted with kaffir beans and two-thirds under ground nuts, dolichos beans for hay, mixed oats and soya beans and velvet beans for ploughing under. The sequence of cropping has been as follows:—

First Year: Maize underplanted with kaffir beans, plus 150 lbs. bone and superphosphate per acre.

Second Year: Ground nuts.

Third Year: Mixed dolichos and velvet beans for hay.

Fourth Year: Maize underplanted with kaffir beans, plus 150 lbs. bone and superphosphate per acre.

Fifth Year: Dolichos beans as a green manure.

Sixth Year: Oats and soya beans for hay.

1928-29.		1929-30.		1930-31.	
Cropping.	Yield per acre.	Cropping.	Yield per acre.	Cropping.	Yield per acre.
1. Maize underplanted with kaffir beans + 150 lbs. bone and supers. per acre	5.91 bags	Ground nuts (Spanish Bunch)	10 bags ½ ton hay	Dolichos beans	0.5 ton hay
2. Ground nuts	9.66 bags	Dolichos beans	1.2 tons hay	Maize underplanted with kaffir beans + 150 lbs. bone and supers. per acre	10.1 bags
3. Dolichos beans for hay	0.57 ton	Maize underplanted with kaffir beans + 150 lbs. bone and supers. per acre	9.21 bags	Velvet beans ploughed under	—
Velvet beans for hay	0.44 ton				
4. Maize underplanted with kaffir beans + 150 lbs. bone and supers. per acre	8.06 bags	Velvet beans ploughed under	—	Oats and Soya beans for hay	1.07 tons hay
5. Dolichos beans ploughed under		Oats and Soya beans for hay	1.5 tons hay	Maize underplanted with kaffir beans + 150 lbs. bone and supers. per acre	10.45 bags
6. Oats and Soya beans for hay	0.5 ton hay	Maize underplanted with kaffir beans + 150 lbs. bone and supers. per acre	10.23 bags	Ground nuts (Spanish Bunch)	8.5 bags

Average yield of maize over three years: 8.33 bags per acre.

Average yield of ground nuts over three years: 9.12 bags per acre.

Average yield of dolichos beans for hay over three years: .75 ton per acre.

Average yield of oats and soya beans for hay over three years: 1.03 tons per acre.

It will be noted that the yields of maize and of the oat and soya bean crop were increasing.

Rotation S (2), on heavier red contact soil.

This is intended as a typical six-course rotation for the sand veld dairy farmer on fairly strong contact soil. The rotation consists of maize with fertiliser, beans for hay, sweet potatoes, maize with fertiliser underplanted with kaffir beans, half ground nuts, half sunflower and a green manure crop every sixth year. In practice the feeds grown would be supplemented with veld hay.

Plot.	1928-29.		1929-30.		1930-31.	
	Cropping.	Yield per acre.	Cropping.	Yield per acre.	Cropping.	Yield per acre.
1.	Maize underplanted with kaffir beans + 150 lbs. bone and supers. per acre	15.25 bags	Velvet beans Dolichos beans	1.2 tons hay 1.5 tons hay	Sweet potatoes (Calabash leaf)	1.6 tons tops 2½ tons tubers
2.	Velvet beans for hay	0.58 ton hay	Sweet potatoes (Calabash leaf)	9 tons tops 6½ tons tubers	Maize + 150 lbs. bone and supers. per acre	12.4 bags
3.	Sweet potatoes (Calabash leaf)	Poor crop on new land	Maize + 150 lbs. bone and supers. underplanted with majortas	9.66 bags	Ground nuts Sunflowers	10.86 bags 5.0 bags
4.	Maize underplanted with kaffir beans + 150 lbs. bone and supers. per acre	12.08 bags	Ground nuts (Spanish Bunch) Sunflowers (Large Black)	14.6 bags 11.0 bags	Dolichos beans ploughed under	—
5.	Ground nuts (Spanish Bunch), Sunflowers	Poor crop new land	Dolichos beans ploughed under	—	Maize + 150 lbs. bone and supers. per acre underplanted kaffir beans	13.2 bags
6.	Dolichos beans ploughed under		Maize + 150 lbs. bone and supers. per acre underplanted kaffir beans	10.66 bags	Dolichos beans Velvet beans	0.84 ton hay 1.0 ton hay

Average yield of maize over three years: 12.20 bags per acre.

Average yield of ground nuts over two years: 12.73 bags per acre.

Average yield of sunflowers over three years: 8.0 bags per acre.

Average yield of sweet potatoes over two years: 5.3 tons green tops per acre; 4.5 tons tubers per acre.

Average yield of dolichos beans over two years: 1.02 tons hay per acre.

Average yield of velvet bean hay over three years: 1.39 tons hay per acre.

(To be continued.)

Dr. A. F. Joseph has retired from the Deputy Directorship of the Imperial Bureau of Soil Science, a post which he has held since the inception of the Bureau in May, 1929. He brought to his task a full knowledge of soil problems in different parts of the Empire and a ripe experience in dealing with them; further, his attractive personality helped greatly in smoothing over many of the difficulties of establishment and organisation.

The purpose of the Bureau is to supply information to agricultural departments and soil investigators in different parts of the Empire, and the work is complicated by the widely-varying problems which have to be attacked. Dr. Joseph has been eminently successful not only in sending out information of the kind that was wanted, but also in putting different workers in touch with one another and so economising time and effort.

It is with deep regret that all those concerned with the Bureau will hear of his decision to retire.

The Potato

(Solanum tuberosum.)

(Continued.)

METHODS OF CULTIVATION IN SOUTHERN RHODESIA.

By S. D. TIMSON, M.C., Dip.Agric. (Wye),
Assistant Agriculturist.

Selection within a Variety from a Healthy Crop.—The researches of Profeit and Findlay, extending over five years, have demonstrated that selection of tubers within any one variety, *provided the crop is free from disease*, has no effect on the yield of a crop. For five years in succession they made selections from heavy cropping plants and light cropping plants, and from heavy crops grown on fertile soils, as well as from poor crops grown on infertile soil. At the end of this period no significant differences in yield were obtained, and selection had completely failed to affect the yield of the crop. As already pointed out, however, selection within a variety for freedom from virus and other diseases will materially affect the yield.

Sorting Seed Tubers.—It has been shown above how profoundly the size of the seed tubers affects the yield of the crop, and experimental evidence has been adduced to assist the grower to determine the best size of seed to suit his own aims, but the difficulty of sorting his seed to obtain the proper weight of set still remains. The average individual weight of tubers which will pass, say, over a 1¾ inch riddle and through a 2 inch one, has been shown by Salaman to vary very greatly with different varieties, but within any particular variety the variation will be small. Therefore the

grower is advised to select a small number of tubers of the desired weight, and then find the proper size of riddles over which and through which these will pass.

Relation between the Number of Eyes on a Set and the Number of Stalks on the Plant.—There is no such relation, and Appleman has shown that the number of stalks produced is largely a question of the degree of inhibition exerted by the apical bud over the other buds, but, as pointed out elsewhere, this inhibition may be destroyed by cutting the tuber transversely, or by removing the apical bud.

Cutting the Seed.—A very large number of experiments relative to the practice of cutting seed have been carried out all over the world, and sometimes with contradictory results owing to the variation in local conditions of soil and climate, but the following generalisations may be stated:—

(1) Whole seed will always give better results than cut sets of similar weight.

(2) Whole seed gives somewhat earlier maturity than cut seed.

(3) The larger the cut portion of a tuber the greater will be the yield per acre, from one "eye" up to the whole tuber.

(4) Smaller pieces of tubers and smaller whole tubers can be used in fertile or wet soil than in poorer soil or when planting in dry soil without irrigation.

(5) When the main crop is planted in dry soil before the arrival of the rains, seed should never be cut, and, *vice versa*, cut seed should only be planted in wet soil, or should be irrigated immediately if planted in dry soil.

(6) With a constant size of seed, increasing the stand of plants per acre up to a certain limit, increases the total yield, but reduces the yield per plant and the average size of the tubers.

(7) Whole seed is less liable to attack by disease than cut seed, especially if it has been "greened" and exposed to light.

Large Cut Seed versus Smaller Whole Seed.—The question as to whether seed of large size cut in halves will yield as well as whole seed of normal planting size or smaller, has

been under investigation at the Agricultural Experiment Station, Salisbury, during the 1930-31 season. Seed of about 10 ozs. weight was cut in halves longitudinally through the "rose" end, and the halves planted separately. Whole seed of 2½ ozs. and 4-5 oz. weight were tested against the cut seed. The experiment was planned in the form of two 4 x 4 Latin squares. The tubers were planted on the 11th October, and the first effective rain fell on the 18th November. Manurial treatment: 18 tons of farmyard manure and 400 lbs. of double complete potato fertilizer per acre. The seed used was the first generation from imported Scotch seed, the variety being Up-to-Date.

The results are tabulated below:—

1st Series.

Type of seed.	Average weight of tubers or pieces. Ozs.	Planting distance in rows. Inches.	Weight of seed per acre. Lbs.	Yield per acre Average of 4 plots. Lbs.	Nett yield per acre after deducting seed, in bags of 150 lbs. each.
Whole tubers	2.5	15	1,815	23,148	142
Small whole tubers ...	0.8	15	581	18,756	121
Immature whole tubers	1.5	15	1,090	20,628	124
Large tubers halved ...	5.0	15	3,630	17,532	93

The standard error is 9.8 bags.

A significant difference in yield is therefore three times this, or 29.4 bags per acre.

2nd Series.

Whole tubers	2.5	15	1,815	22,860	140
Small whole tubers ...	0.8	9	968	17,388	109
Small immature tubers	0.4	9	290	16,330	107
Large tubers halved ...	5.0	15	3,630	17,028	89

The standard error is 5.8 bags.

A significant difference in yield is therefore 17.4 bags per acre.

Potato growers frequently find difficulty in marketing their largest tubers, and the above experiments were designed to discover whether such large tubers when cut in halves would give as satisfactory results for seed purposes as normal

sized seed. In both series it will be seen that the normal size tubers of $2\frac{1}{2}$ ozs. weight have given the best results, while the halves of large tubers weighing twice as much have proved the least productive. The small seed of .8 ozs. each have also given better results than the large half tubers. *It would therefore appear to be preferable to use small whole tubers considerably below normal size than to use halves of large tubers for planting the main summer crop.* The question as to whether immature seed will give better results than mature seed is not decided by these experiments, and further work on this point is necessary. These results also confirm previous experiments conducted on this Station in showing that the use of very small seed is poor economy, but show that if suitable seed is not available a fair crop can be obtained by their use.

Methods of Cutting Seed.—A thin very sharp knife should be used. If, as is advisable, the seed has been sprouted, and it is to be cut in not more than two pieces, it should always be cut longitudinally through the "rose" end so that each piece has one or more vigorous sprouts on it. If *sprouted* seed is cut transversely, the "rose" end will always give a better yield than the "heel" end, owing to the fact that it already possesses vigorous sprouts, whilst the eyes at the heel end are still dormant owing to the inhibition of the apical bud. *Unsprouted* seed should be cut transversely, as this ensures pieces of more blocky shape and with less cut surface to cause drying out. The two halves in this case will give equal yields and will produce equally vigorous shoots, since transverse cutting destroys the inhibition of the apical bud; it also cuts short the resting period of the tuber and thus accelerates sprouting.

In practice, however, unsprouted seed is seldom, if ever, used for cutting owing to the longer period it must be in the soil before growth takes place and the leaves appear above ground, and the consequent increased drying out and risk of disease it must undergo. The general practice in Great Britain, where cut seed is used, is to cut the sprouted tubers longitudinally into halves. In America the tubers are frequently cut in three or more pieces in order to economise seed, but the price of table potatoes and seed must be high to make it economical to do so. In this Colony the

cutting of seed is not recommended, as it is considered that the prices normally obtainable for potatoes and the lower yields obtained from cut sets, do not justify the practice. However, growers are sometimes forced to use cut sets owing to shortage of seed; but even then it is not likely to be profitable to cut tubers into more than two pieces.

It is the common practice to dust the cut surfaces with fine wood ashes or slaked lime, to protect the tuber from undue drying out and attack by disease, and to plant the cut sets immediately in moist soil. It is probable, however, that it would be better practice to place the cut sets in the shade in a cool moist atmosphere (a tobacco barn could provide these conditions) for about two days until the cut surface has become dry and the corky protective layer is formed. The cut surfaces should then be smeared lightly with a disinfectant, such as Stockholm tar, to prevent the attack of disease, and the sets can then be planted. It has been proved that shade and moisture encourage the quick formation of the corky layer on the cut surfaces, and that exposure to sunlight and a dry atmosphere retards and more or less prevents it.

Mr. L. C. Vereker, one of our most experienced and successful growers of potatoes, makes it his usual practice, when he is forced to plant cut seed (under irrigation), to allow the sets to dry out thoroughly for about ten days. He then smears the cut surface with Stockholm tar before planting. He states that he obtains better stands and better yields by this treatment than by planting the seed immediately after cutting.

Some varieties are more intolerant of cutting than others, and Majestic is notable in this respect. Salaman states, however, that "a well-known grower in Yorkshire has found that by cutting the tuber three-quarters of the way through a fortnight before planting, and then boxing in the shade, he could induce Majestic as well as most other varieties to suffer cutting with impunity." A small-scale experiment by the writer indicates that this method is worth further trial in this Colony, with unsprouted seed.

Weight of Seed per Acre.—From 1,200 to 2,700 lbs. of seed tubers between 2—2½ ozs. in weight will be required to

plant an acre, varying with the planting distances and the average weight of seed used. The weights of seed required for some of the commoner spacings is given in the following table:—

36 x 15 inches	—2 oz. seed	—1,452 lbs.
36 x 15 inches	—2½ oz. seed	—1,815 lbs.
36 x 18 inches	—2 oz. seed	—1,210 lbs.
36 x 18 inches	—2½ oz. seed	—1,512 lbs.
30 x 12 inches	—2 oz. seed	—2,178 lbs.
30 x 12 inches	—2½ oz. seed	—2,722 lbs.
30 x 15 inches	—2 oz. seed	—1,742 lbs.
30 x 15 inches	—2½ oz. seed	—2,184 lbs.
30 x 18 inches	—2 oz. seed	—1,452 lbs.
30 x 18 inches	—2½ oz. seed	—1,815 lbs.

Degeneracy and Selection.—Recent research carried out in Great Britain has shown, as already mentioned above, that tuber selection within a variety *that is free from virus disease* does not affect the yield of the crop. This is what one would expect, since the method of reproduction is a vegetative one. But when the crop is infected with virus disease then a quite different state of affairs results, and selection of tubers properly carried out will go far to maintain the yield of the crop by reducing or restricting the extent of the infection.

It is very doubtful if any imported seed arrives in this Colony completely free from virus infection, but it is quite certain that after it has been grown in this Colony for two or three years, *degeneration of the yield due to virus disease is rapid if proper selection methods are not practised.* Selection of seed from a bulked crop solely according to size, tends to cause a rapid increase of the virus diseases, since one of the principal symptoms of such diseases is an increase in the proportion of small tubers borne by a plant, and it is these small tubers which are used for seed.

If, however, selection of seed is done each year in the field from highly-yielding plants which show no signs of infection by virus disease, a high level of yield may be maintained, as has been demonstrated at the Agricultural Experiment Station, Salisbury. During the past season (1930-31) the following results were obtained. The yields are given

in bags of 150 lbs. per acre, and are the means of four plots:—

Seed—1st generation from imported seed.	Seed—9th generation from imported seed. Carefully selected.	Seed—9th generation from imported seed. *Not* selected carefully.
140	**124**	**41**

These results are startling and require no comment. They demonstrate clearly that careful methods of selection will assure the maintenance of a high level of yield. Figures 4 and 5 (August issue, R.A.J.) illustrate pictorially the advantages of selection of tubers from healthy plants as against the neglect of this practice. These are photographs of two of the plots in the experiment just quoted.

Advice on the proper methods to employ can be obtained from the Division of Plant Industry.

Change of Seed.—Mundy * quotes the case of one Southern Rhodesian farmer who had raised over 20 consecutive crops from the original imported seed. He states: "This gentleman has irrigated and, and claims that the alternation of summer and winter crops is all the change needed" to ensure the maintenance of the vigour of the crop. There is no doubt that winter-grown crops of potatoes are less infested with aphis and other possible insect vectors of virus diseases, and it is highly probable, if not certain, that seed from a winter-grown crop will be freer from virus infection than that from a summer-grown crop. For these reasons it would appear likely that the more elevated portions of the Colony on the eastern border, where irrigation is available for growing the crop in winter, could supply seed of high quality for the remainder of the country, and this would save much of the expenditure laid out each year on the importation of seed from Scotland.

The degeneration of a variety of potatoes from the date of importation of "seed" into this Colony is almost entirely due to increasing infection by virus diseases, especially the so-called "streak" disease. The virulence of these virus diseases is probably enhanced in Southern Rhodesia by the high temperatures obtaining during the summer growing season.

* "Sub-Tropical Agriculture."—H. G. Mundy.

In the section of the above article under the heading "Acceleration of Sprouting," which appeared in the September issue of the Journal, it is stated that the power of carbon bisulphide to break the dormancy and accelerate the sprouting of potato tubers was discovered at the Agricultural Experiment Station, Salisbury. It has been pointed out to the writer by the manager of the Station that this is not the case, and that the basis of his investigations was the original work on the subject carried out by P. van der Goot in Java. It is desired to acknowledge the error, and the origin of the data used in the work carried out at the Salisbury Station.

(To be continued.)

AN ADDRESS BOOK OF BOTANISTS.

Messrs. Bailliere, Tindall & Co. are publishing shortly for the Bentham Trustees the "International Address Book of Botanists," which has resulted from the resolution of the Fifth International Botanical Congress, 1930. This will be on lines somewhat similar to Dorfler's "Botaniker Adressbuch," and will contain the names of some 13,000 to 14,000 botanists and botanical institutions, etc., in all parts of the world. These will be arranged alphabetically by countries, will be printed in the majority of cases in the language of the country in Roman script and will be provided with an index of personal entries and geographical indices. The low price of 12s. 6d., or 13s. post free, is rendered possible owing to the assistance the International Committee has received from the Bentham Trustees and the Carnegie Corporation of New York. Messrs. Baillière, Tindall & Cox, whose address is 7 and 8 Henrietta Street, Covent Garden, London, W.C. 2, can now accept advance orders at these prices.

The Weather Map and the Short Period Weather Forecast.

(Issued by the Meteorological Office, Salisbury.)

The earliest weather maps plotted in Europe showed that weather is closely associated with the pressure distribution as shown on an isobar map, and the attention of meteorologists was, for a long time, concentrated on this map, which appeared to hold the key to the solution of the problem of weather forecasting. As investigations proceeded, it became evident that the isobar map alone was inadequate for the purpose, and since the opening of the twentieth century many avenues have been explored and considerable progress has been made.

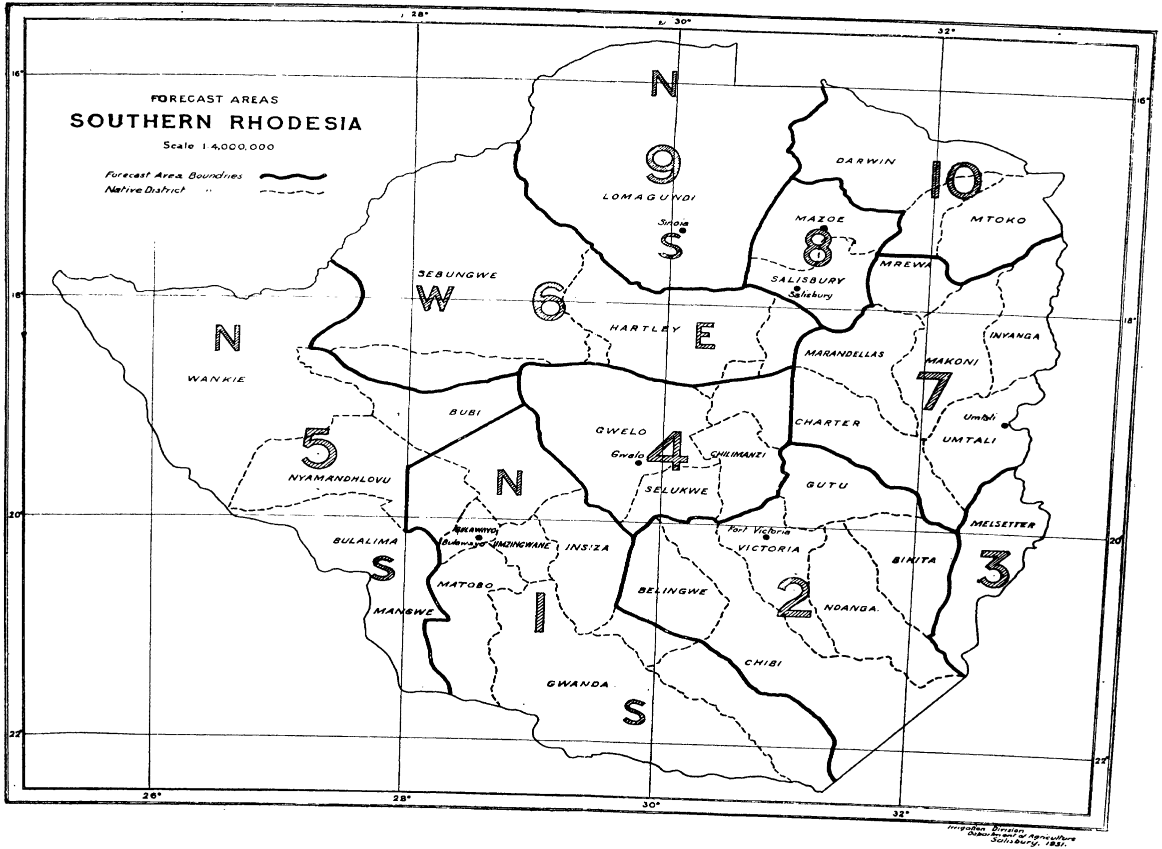
One outcome of recent investigations has been the development of the Polar Front Theory. This theory takes little or no account initially of pressure distribution, and is based on the physical characteristics of the air. It is postulated that the atmosphere is composed of bodies of nearly homogeneous air, each body having its own physical characteristics, which are determined by its past history. Different air bodies do not mix readily, and the line of contact between the two air bodies is called a "front." The majority of these fronts are distinguishable on a weather map by reason of conflicting winds and temperature differences; in addition, moving fronts are always associated with cloud and generally with rain. The development of this theory has lead to considerable changes in the weather map, and the temperature and wind have assumed a new importance. It is customary now to draw in the fronts first and to complete the isobars to conform to them. This is necessary, as a front represents a real discontinuity in the air and the isobars show a kink when crossing a front.

Southern Rhodesia Weather Maps.—Telegraphic weather messages are received daily in Salisbury from a network of stations in Southern Africa from the Congo to the Cape; a certain amount of information is also collected from Madagascar and Mauritius. A general weather map on a small scale is plotted, showing pressure, temperature, wind, cloud and past and present weather. The main feature of this map is the isobars, which are further studied on maps showing the deviation from normal of the pressure and the pressure change in 24 hours.

The features of these maps and the inferences to be drawn from them have been set out by Mr. C. L. Robertson, B.A., B.Sc., Chief Irrigation Engineer, in a paper read before the Rhodesia Scientific Association in 1926. In this paper the weather was considered purely in relation to the pressure distribution and changes and the weather maps were classified into types. Experience in Southern Rhodesia has followed that in Europe and has proved that this method is only of limited value, and it has been necessary to explore other avenues.

The general appearance of South African weather maps is entirely different from those of Europe. The central feature in Europe, the "cyclone," is never seen in its entirety, and the trough of low pressure between two anti-cyclones or highs takes its place. European forecasting methods are not directly applicable but require considerable modification, and factors of little moment in the temperature zone become all-important in the tropics.

In the present state of our knowledge plotting of the detailed maps necessary for frontal analysis over the whole of South Africa is not warranted on the score of expense, and it is unfortunately not practicable to obtain the detail immediately outside, and in some parts inside our borders, particularly over the Kalahari and along the Zambesi Valley. The number of reporting stations in Southern Rhodesia has been increased materially, and it is now possible, at least in retrospect, to attempt local frontal analysis. A large-scale weather map is prepared showing the weather in as great a detail as possible over Southern Rhodesia and neighbouring areas. This map is used for the forecast and is subsequently completed by the addition of the rainfall and time of rain


FORECAST AREAS
SOUTHERN RHODESIA
Scale 1:4,000,000
Forecast Area Boundries
Native District
LOMAGUNDI
Sinoia
DARWIN
MTOKO
MAZOE
SALISBURY
Salisbury
MREWA
SEBUNGWE
HARTLEY
WANKIE
MARANDELLAS
INYANGA
MAKONI
BUBI
GWELO
Gwelo
CHILIMANZI
CHARTER
Umtali
UMTALI
NYAMANDHLOVU
SELUKWE
GUTU
MELSETTER
BULALIMA
BULAWAYO
Bulawayo
UMZINGWANE
INSIZA
Fort Victoria
VICTORIA
BIKITA
MATOBO
BELINGWE
NDANGA
MANGWE
CHIBI
GWANDA
Irrigation Division
Department of Agriculture
Salisbury, 1931.

as recorded by about 200 observers. The rainfall experienced in Southern Rhodesia is of various kinds.

Cold Front Rain.—This rain occurs principally in the early and late season and is frequently followed by clearing weather. The general weather map shows a trough of low pressure developing in the west of the Union, the winds in Southern Rhodesia swing to the north and the Colony is invaded by warm, moist air. The northerly winds usually persist for two or three days and thunder showers occur. The trough swings across the Union in an easterly direction and is followed by a well developed high; as the line of lowest pressure passes a station the wind swings from northerly to southerly and becomes very cold. This cold air reaches the south of the Kalahari and is then lost, as no stations are available to trace it further. The centre of the high moves round the coast, and, as the movement of air is retarded over the land surface, the first cold air to reach Southern Rhodesia enters from the south-east up the Limpopo Valley. The Limpopo Valley is a wide shallow basin with a large opening on its eastern side. The cold air invades this basin and pushes the warm air back and upwards, eventually filling the whole basin and flowing over the high veld and down into the Zambesi Valley. This front generally has an east-west direction in Southern Rhodesia, with warm northerly winds to the north and cold south-easterly winds behind it. A second front frequently appears in the west with a general north-south direction and moves to the east down the Zambesi Valley. It is most probable that this air has come over the Kalahari from the west. It is suspected that on occasion cold air moves further up the coast and enters the Zambesi Valley, forming a third front. This would explain the persistence of rain in the north, which is of frequent occurrence.

Apart from these fronts, which can be readily traced from the Cape to the Zambesi, there is evidence that minor fronts associated with small irregularities of the pressure and temperature are of frequent occurrence and are at times associated with heavy rain. Arrangements are now being made to improve the instrumental equipment of stations, and it is hoped that it will be possible later to detect these disturbances and forecast the rain.

Cold fronts are associated with heavy rain usually in the form of thunderstorms, and are sometimes followed in the south by a short period of overcast weather and drizzle. The heaviest rain usually occurs in the south and south-east. If the high establishes itself with its centre inland or near the coast, the weather clears rapidly and a spell of fine weather sets in. The physical principles involved in the formation of rain on a cold front are fairly clear, and it is possible to a certain extent to explain the amount of rain accompanying the phenomenon.

"Monsoon" Rain.—During the middle period of the rainy season the equatorial low frequently approaches or enters Southern Rhodesia; its movements are slow, and the general result is that for several days a steady current of warm, unstable air flows over the Colony from a northerly direction. The skies remain cloudy to overcast and intermittent heavy rain is experienced, particularly in the north and east. No satisfactory explanation of this rain is available.

Convection Showers.—A considerable proportion of the rain in Southern Rhodesia occurs in the form of showers. There are periods when the pressure change from day to day is small and winds are light. The large-scale weather map shows the dew point at each station, and it will be found that air with a high dew point spreads over the Colony and retreats and that the showers are largely associated with this air.

The weather sequence with showers is roughly as follows:—The sun rises in a fairly clear sky after a warm night and small cumulus appear and rapidly grow. Later, some of the cumulus extend to a great height and absorb their smaller neighbours, until by noon or early afternoon the typical cumulo-nimbus appears and rain may occur. These showers fall from individual clouds of no great extent, and it is possible for one end of a farm to receive two or three showers while the other remains dry. It is not possible from an office in Salisbury, or even from a vantage point in sight of the storm, to say exactly where the rain will fall, and the best the forecaster can do is to indicate the probability of a shower occurring at any one point.

Orographic Rain.—Orographic rain is of frequent occurrence on the border mountains and is experienced from time to time at all places on the high veld. The amount of rain precipitated is usually small with purely orographic conditions and no special steps are taken to forecast it. This type is covered by drizzle in the forecasts.

Forecasts.—General forecasts of the probable weather for 24 hours have been issued for a number of years, and whenever possible the area of country particularly affected has been indicated. This forecast has usually been accompanied by a further outlook, indicating very generally the weather anticipated on the following day or for a period.

The improvement in method has made it possible to issue forecasts in greater detail, and for this purpose the Colony has been divided into ten areas (see map). These areas have been selected by careful comparison of the day-to-day rainfall at a number of stations. It was found, for example, that the rainfall at Bulawayo and Nuanetsi is essentially similar, whereas the rainfall at Salisbury and Sinoia is not.

It is now proposed to make a separate forecast for each of these areas. The forecast for the area will be supplied to all Departmental post offices in the area, and should be available at or before 1 p.m. each day.

The customary terminology of the forecaster is frequently criticised on the score of vagueness. This criticism is not entirely fair. There are times when it is possible to state definitely that so and so will happen; there are also times when it appears probable that an important change will take place, and the forecaster considers that he should indicate this although he is unable to make a hard and fast statement. Furthermore—and this is particularly applicable to Southern Rhodesia—the forecaster is concerned with the weather over a large area and judges his successes in relation to the area and not in relation to one particular station. It is well known that showers do not fall equally on all—one farm may be flooded, while the next is dry—and a forecast of "scattered showers" is not an attempt to hedge, but is a statement that showers will occur at some stations in the area and not at others, and that the proportion will be

roughly 1 to 4. From the point of view of the individual, this should be interpreted as a 4 to 1 chance against rain.

Local forecasts in future will be issued in a new terminology in terms of the probability of rain at an individual station.

Rain and Drizzle.—These terms imply cool weather with overcast skies and very little sunshine. Rain is widespread, and all or nearly all stations in an area should receive it. Drizzle is light and usually intermittent, and it is possible that measurable amounts may not occur, but the overcast sky will be general.

Showers are local travelling disturbances. They are associated with hot weather and variable skies. There may be a sufficient number in an area to ensure that the whole area receives rain, or there may be only one or two. General rain of the shower type is largely associated with cold fronts.

Fair or Fine.—Fair will be used to describe weather when the sky is more or less cloudy and there is a remote chance of an odd shower. Fine will represent little or no cloud and no rain.

The terms used are tabulated below:—

General Forecast.	Local Forecast.	Approximate Odds.
Overcast with rain	Rain	10—1 on
Overcast with drizzle	Drizzle	—
Unsettled, with showers general	Showers very probable	4—1 on
Unsettled, with showers fairly general	Showers probable	2—1 on
Unsettled, with showers numerous	Showers possible	2—1 against
Unsettled, with scattered showers	Showers unlikely	4—1 against
Fine, but cloudy, with isolated showers	Fair	10—1 against
Fine and bright	Fine	—

The odds are given as an approximate guide.

The further outlook cannot be given with the same degree of definiteness. The terms of the forecast will be used when possible; otherwise, words indicating the direction of change anticipated.

Clearing will indicate a tendency for the rain to lessen —not the immediate onset of fine weather.

Unsettled will indicate the onset of shower conditions. After rain, it will indicate a tendency to clear, and after fine the onset of showers.

The forecast will apply to the day on which it is issued and the following morning, and the further outlook particularly to the following afternoon. For example, a forecast "Rain, then unsettled" received at 1 p.m. will indicate dull overcast skies with rain during the afternoon or night, and a break up of the clouds the following day, with warmer weather and the probability of a shower during the afternoon or night.

If at any time during the rainy season it appears that the weather will remain fair or fine for several days, the word "period" will be used in the further outlook. This word will be repeated from day to day until such time as signs appear of the break up of the fine weather.

Recent examination of the daily rainfall for over thirty years at Salisbury and Bulawayo has shown that rain is almost certain at Salisbury between the 25th November and 2nd December. On one occasion only in three years has a drought extended through this week.

It has been customary in the past to issue a special further outlook on the first occasion in the season when a spell of wet weather may be expected. This forecast is issued especially for tobacco growers and will be continued. The term used in the further outlook will be "unsettled period."

Air Routes.—Weather reporting stations have been equipped along the air route from Broken Hill via Salisbury to Pietersburg, and weather reports and storm warnings will be available for aircraft on regular services. Forecasts for twenty-four hours in terms of the "General Forecast" will be posted daily at the Salisbury and Bulawayo aerodromes, and special short period forecasts will be issued whenever necessary.

The small amount of air traffic at the present time does not warrant the organisation of special daily weather reports. The ordinary meteorological network covers the Colony fairly well, and special messages can be arranged to cover any individual flight.

Foot and Mouth Disease.

It is hereby notified for public information that the following restrictions are imposed by the Government of Northern Rhodesia on the passage of the commodities enumerated below in transit to the Congo:—

1. The passage of maize (excluding maize meal), kaffir corn, sweet potatoes, potatoes, millet, ground nuts, beans and butter will be permitted in closed trucks of such construction that when sealed no produce can be removed therefrom or introduced thereto without breaking the seal.

2. Such trucks shall, prior to loading, be disinfected internally and externally to the satisfaction of the Veterinary Department with an approved disinfectant, and shall, when loaded, be sealed by a person authorised thereto.

3. The trucks shall be attached to such trains as will ensure their passage through Northern Rhodesia with the least possible delay.

4. All such maize, kaffir corn, millet, ground nuts, sweet potatoes, potatoes or beans shall be accompanied by a certificate signed by the Chief Veterinary Surgeon that foot and mouth disease has not occurred on the farm of origin.

5. Maize, kaffir corn, millet, ground nuts, sweet potatoes, potatoes and beans for export to the Congo shall be conveyed from the farm of origin to the railway by such routes as may be prescribed in a permit granted by the Chief Veterinary Surgeon, and shall be immediately loaded in a truck as prescribed in Sections 1 and 2 hereof under the supervision of an officer appointed for that purpose, provided that if immediate loading is not possible they shall be stacked or stored in such manner and at such siding reserved for the storage of products for the Congo as may be prescribed by the Chief Veterinary Surgeon.

6. Butter will be allowed in transit provided that:—

(a) The cream from which it is manufactured is certified as derived from a farm on which foot and mouth disease has not occurred;

(b) Upon arrival at the creamery all cream shall be subjected to pasteurisation. The whole of the cream brought to the creamery, whether designed for butter which shall be exported or consumed in Southern Rhodesia, will be subjected to this process;

(c) After churning, the butter shall not be removed to any room into which unpasteurised cream is brought or subjected to any contact with articles which have been in contact with unpasteurised cream;

(d) It shall be packed into cases which have been disinfected, and such cases shall not be removed into any room into which unpasteurised cream is brought, or subjected to any contact with articles which have been in contact with unpasteurised cream.

7. The passage of eggs in transit through Northern Rhodesia to the Congo will be permitted, provided that the eggs shall be packed in boxes which do not contain any prohibited packing, and that after the eggs have been packed the boxes shall be disinfected.

8. As the importation of frozen meat from Southern Rhodesia is prohibited in the Congo, regulations relating to the passage in transit of frozen meat are in abeyance.

9. Butter, the manufacture of which complies with the provision of Section 6, and eggs packed in accordance with the terms of Section 7 of this notice will also be admitted to Northern Rhodesia for local consumption.

Rothamsted Experimental Station, Harpenden, Herts.

ANNUAL REPORT, 1930. 172 pages. Price: 2/6.
(Obtainable from the Secretary.)

Those interested in agriculture more particularly from the point of view of plant nutrition and disease will find in the annual report of our oldest experimental station the record of a tremendous amount of detailed work conducted both in the field and in the laboratory. The station controls two farms, one on the heavy land at Rothamsted and another on a light soil at Woburn; and arrangements are also made whereby experiments may be conducted on the land of a number of progressive farmers in many parts of England. Fertiliser experiments, which are capable of a high degree of accuracy and provide an estimate of the reliability of the results, are carried out on a system recently developed at the station. This is an essential feature of experimental work in the field and greatly adds to the value of the results for advisory purposes. In the present report the conclusions of the year's experiments on the effect of fertilisers on farm crops are given and related to the results obtained in previous years. This section forms for specialists, students and progressive farmers an authoritative statement of the present position with regard to fertiliser experimentation in England. For the expert, the primary data on which the conclusions are based are printed in full.

As an example of the field work on fertilisers may be taken a potato experiment of 1930, in which the point under investigation was the effect of the "balance" of the various nutrients on the yield and composition of the crop. This is one of the most fruitful kinds of experiment, because although the necessity for nutrients has been widely demonstrated, there is little information about the proportions

necessary to give the best results. This experiment, like most others, showed the interdependence of the manures supplying nitrogen, potash and phosphoric acid. Nitrogen and potash mutually increased each other's effect, while the two together markedly increased the effectiveness of phosphoric acid. Similar work on yield and quality is recorded for barley, sugar beet, forage mixtures and grass land. Next are described two new rotation experiments started in 1930 and intended to be continued for a period of years. One is designed to test various alternative methods of returning to the soil the straw grown on the holding, and also provides a comparison of rock phosphate with superphosphate. The other, conducted both at Rothamsted and Woburn, brings out season by season the effects on six different crops of a series of doses of the common nutrients, and will eventually form the basis of the study of the effect of season on fertiliser action.

Work in the field by no means exhausts the activities of the station. Much of the report deals with the object and results of the varied laboratory investigations on plant nutrition and plant disease. Many of these are highly technical, and are at present of purely scientific interest; but nevertheless such work is necessary for the future solution of technical problems. A few of the lines of work which have direct contact with practice may be mentioned. The results of scientific study of the nodule bacteria of the lucerne plant has now been carried into practice, and artificial inoculation of lucerne seed, according to a technique devised at Rothamsted, is commonly carried out by growers of this crop. Over 4,000 acres of lucerne was sown down with inoculated seed during the period covered by the report.

A further application of microbiological research is to be found in the artificial rotting of straw and other vegetable wastes by the controlled activities of fungi and bacteria. This is widely used in the preparation of organic manures at home and in the colonies, and the product is being exhaustively tested in the field experiments. The course of decomposition is being further studied.

In the Physics Department a systematic study of soil cultivation is being made with the object of putting this

costly item in the farmers' expenditure on a scientific footing. A beginning has been made with a detailed examination of the effects of rotary cultivation. The physical action of the treading of sheep, so important on light land farms, is also being studied.

In the Department of Plant Pathology, the most extensive investigation is concerned with the so-called virus diseases which seriously damage a wide range of economic crops. This is a problem of such complexity that systematic research from many points of view will be necessary before practical results can be expected, and a team of specialists are engaged in this work.

The report contains abstracts of over 70 scientific papers published during the year, as well as a list of 30 technical articles of a practical character.

On reading this report one is struck with the fact that as soon as the simplest aspect of crop production is brought under examination, the investigator is led into paths so obscure that only the expert can follow them. Much of this work will bear fruit in time, but is at first incomprehensible to practical men. At the same time there is much on record which can be turned to immediate account by those who are on the look out for the best information in matters appertaining to plant nutrition and soil management.

Power Alcohol in Southern Rhodesia.

By C. L. Robertson, B.Sc., A.M.I.C.E.,
Irrigation Engineer.

The question as to whether it would be desirable to foster an industry for the production of power alcohol from locally grown products for use as a motor fuel has been very much to the fore in recent months. The subject is one which is naturally of interest to farmers, as it offers an additional local market for a portion of the exportable surplus maize crop, and it would be appropriate, therefore, to refer to this matter in the columns of the Journal and give a short summary of the tests carried out and the action taken by the Government.

The Select Committee of the Legislative Assembly appointed in May last to investigate the proposal recommended that legislation should be introduced providing for the inclusion of 20 per cent. of 99.8 per cent. alcohol in all petrol sold in Southern Rhodesia as soon as supplies of such alcohol are available. The manufacture of 99.8 per cent. alcohol was commercially possible by means of the "Merck" process, an option on the patent rights for this process being held by Baron von Roretz for the whole of Southern Africa. The committee further expressed the opinion that should anything happen to prevent Baron von Roretz raising the capital, steps should be taken by the Government to secure the patent rights of the "Merck" process for Southern Rhodesia. As the option in the patent rights was due to expire at the end of June, the Government took steps to ensure the renewal of the option until the end of September, and further arranged for the importation of 100 gallons of alcohol in order that tests could be carried out with the petrol-alcohol mixture on cars running under local conditions. It was considered advisable to conduct these local tests, as the evidence avail-

able for the Select Committee was conflicting on the point as to whether as large a mileage per gallon was available if the mixture were used instead of petrol. A representative committee was appointed to conduct these tests and determine this point.

To obtain a fair comparison between the two fuels, it was necessary to ensure that—

(a) cars utilised for the test should be representative of the cars in common use in Southern Rhodesia;

(b) the tests would be a true reflection of average road conditions in this Colony, both as to town and country running;

(c) no undue refinements be permitted with regard to carburettor and timing adjustments when the fuel is changed from petrol to the mixture, i.e., to determine whether the ordinary motor car user would be able to detect any marked difference between running on the mixture or on petrol;

(d) equal running conditions are obtained for the cars running on petrol and the mixture.

The cars utilised for the tests were Ford, Austin, Chevrolet and Crossley cars, and later tests were run on Willys Knight and Morris Minor cars and on Thornycroft lorries. Three series of tests were run, viz.:—

(1) Mileage on 1 gallon of petrol as compared with 1 gallon of mixture. This test was intended to determine whether carburettor adjustment was correct for economical petrol consumption.

(2) Consumption of petrol and the mixture on an average country run of 120 miles.

(3) Mileage performed on 1 gallon of petrol as compared with 1 gallon of mixture under town running conditions.

Two of each type of car were used in each test, and in order to ensure equal running conditions for the two fuels, each test was duplicated—in the first run one of each pair of cars ran on petrol and the other on the mixture, the process being reversed on the second run. In addition, the speed conditions to be maintained were definitely laid down

for each test, and members of the committee went as observers on each occasion. Very consistent results were obtained throughout for each type of car.

The general results were satisfactory for the mixture, as 1,212.4 miles were run on 57½ gallons of the mixture, as compared with 1,192.4 miles on the same quantity of petrol. As a result of these tests the committee reported it was satisfied that—

(a) The 20 per cent. petrol-alcohol mixture may be stated to be a satisfactory fuel when used in motor vehicles without carburettor adjustment.

In the case of cars with high-speed engines, there is a distinct improvement in mileage; but in cars with lower speed engines no improvement was noted, and in certain cases there was a small loss.

(b) There was a marked improvement in both mileage and hill climbing with heavy vehicles running on the mixture.

(c) The average motor car owner would not be able to detect any appreciable difference in mileage consumption or running properties of his car when it was running on petrol or the mixture, nor would it be necessary for him to make any adjustment to the carburettor.

Later tests indicated that a slightly improved mileage could be obtained from the mixture if a minor adjustment were made to the carburettor.

After this report was received the Government made the following offer to Baron von Roretz:—

(1) The term "alcohol" shall be taken to mean dematured alcohol containing not less than 99.8 per cent. pure alcohol.

(2) The sale price of this alcohol shall be not more than 1s. 6d. a gallon ex factory in bulk.

(3) The company producing the alcohol shall be entitled to use any vegetable product grown in Southern Rhodesia as the raw material from which the alcohol is derived.

(4) The Government will as from an agreed date, when a sufficient quantity of alcohol is available for sale, grant a rebate of the duty on petrol of 3d. per gallon, on the basis that the rebate shall be granted on four gallons of imported petrol in respect of each gallon of alcohol utilised in conjunction with the petrol as a fuel.

(5) The terms and conditions on which the rebate may be granted shall be in the discretion of the Government.

(6) The company to be formed by you for the production of alcohol shall be under a definite obligation not to enter into any agreement to supply alcohol to any company importing or selling petrol on any exclusive terms without the consent in writing of the Government to such an agreement.

This offer was accepted, and efforts are now being made to float a company with the necessary capital (about £70,000) required to equip and operate the distillery.

It is sincerely to be hoped that these efforts to raise the capital locally will be successful, as the venture promises to be of material benefit to the Colony in many ways, e.g.:—

(a) The retention of money in circulation in the Colony which is at present sent overseas for the purchase of petrol. In the initial stages it is expected that the annual production of alcohol will be 800,000 gallons, which is approximately one-fifth of the local consumption of petrol last year. This estimate does not take into account the possibility of the export of alcohol to neighbouring territories, such as Nyasaland.

(b) The provision of an additional local market for 100,000 bags of maize or other suitable vegetable produce.

The following figures show that the sweet potato would probably be the most economical source of alcohol in this Colony. On the basis of an eight-bag yield, one acre under maize would produce 64 *gallons of alcohol*. On the basis

of a six-ton yield, one acre under sweet potatoes would produce 180 *gallons of alcohol.*

(c) The residue obtainable from the grain after the production of alcohol is a valuable by-product, which would be available for stock-feeding purposes at an economical price.

(d) The promotion of a secondary local industry would be of general advantage.

Farming Calendar.

October.

BEE-KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolic cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Citrus trees should not be permitted to suffer for want of water if a good setting of fruit is desired. Continue irrigation at fairly frequent intervals, especially if it is windy. Cultivation must follow each irrigation when the soil is fit to work, otherwise a large amount of moisture will be lost by evaporation. The packing of late fruit for export should be completed early in the month or before the rains commence. If rains intervene, the carrying properties will be affected and the fruit will probably break down in transit. Suppress all stem growths or water shoots as they appear. Young trees planted last season may with advantage have the stems whitewashed or washed with Bordeaux-mixture paste; this will prevent undue sun-scalding of the unprotected stems. Plant cover crops with the first good rains.

CROPS.

If not already attended to, overhaul all farming implements and replace worn parts to ensure efficiency. Shell ground nuts required for the season's planting. Ploughing of old lands should, at latest, be finished this month. If seed potatoes will not keep in good condition until next month, they may be planted now, but later planting is better. Edible canna may be planted this month before rain falls. Also velvet beans, dolichos beans and sunn hemp towards the end of the month for green manuring. Harvest winter cereals and plough under the stubbles as soon as possible after harvest. When rains have fallen, use every effort to improve the tilth of the lands which will be the first to be planted. On cloddy lands already ploughed, seize the opportunity to break down the clods by disc and drag harrowing as showers of rain fall. A spiked roller is very useful for this work. A good tilth means good planting, and a good stand of maize; therefore, do everything possible by cross ploughing, disc and drag harrowing to bring the soil into good condition for seeding.

When necessary, keep the harrows going to check early weed growth. Clean lands at this time of year are an insurance against cutworm and other insect pests. If weather conditions permit, plant a trap crop of maize to attract the stalk borer. New land to be ploughed and intended for planting this season should be cleared of heavy grass or weeds by burning or cutting to ensure good work being done by the ploughs.

Seasonal showers of rain are liable to spoil bricks unburned. See that bricks which have been made are protected from rain. Clean out guttering and down-spouts of house and farm buildings. Press on with development work so as to have this completed before rains break.

DAIRYING.

During the month of October and until such time as the rains have commenced and green grazing is available, dairy stock require to be almost entirely stall fed. Cows in milk and cows due to calve should be liberally fed on succulents and concentrates in order that they may commence the dairying season in good condition, and make full use of the early grazing for milk production. Dairy cows that are underfed at this time of the year invariably produce milk of poor quality, and usually throw weedy undersized calves; furthermore, they do not pick up in condition until comparatively late in the season.

During October, the cow's ration should consist of succulents such as silage or green feed, etc., legume hay of good quality and a liberal allowance of concentrates; a pound or so of a feed such as ground-nut cake is invaluable for dairy stock at this time of the year.

Weather conditions are generally fairly warm during the month of October, and every precaution should be taken to keep the cream, which is used for butter-making or which is sent to the creamery, as cool as possible. The can or bucket containing the cream should be placed in a basin of water or concrete trough, in the dairy, and exposed to a draught; a piece of kaffir blanket, which dips into the water, should be wrapped around the can or bucket containing the cream. Churning of cream for butter-making is best carried out early in the morning—before sunrise if possible; the coolest water obtainable should be used for washing the butter whilst in the granular stage.

At this season of the year cheese-makers may find that the milk is deficient in butter fat; this is generally the result of under-feeding or unsuitable feeding. Cheese made from milk of low fat content is invariably dry and hard, defects that are accentuated by over cooking the curd or by cooking at too high a temperature. The curd should be firmed in the whey at a temperature not higher than 98° F. to 100° F.

DECIDUOUS FRUITS.

Keep all trees well watered until the rains commence; cultivate after each watering to prevent evaporation of added moisture. Rub off all undesirable shoots, such as those arising on the main stem near the ground; also those shoots having a tendency to crowd each other. Two or more shoots should not be allowed to develop from the same spot on any part of the tree. Rub off the weaker ones soon after they appear. The fruit of early peach trees should be thinned out if a heavy crop has set; this thinning will result in a crop of large-sized fruit. All fruit should be thinned out if necessary.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize, crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough by December to outgrow serious damage. Maize beetle is now in its pupal stage. Thorough working and smashing up of the soil at this time will destroy great numbers.

Tobacco.—See notes for last month, together with article in the "Rhodesia Agricultural Journal" for October, 1926, on "Baiting of Tobacco Seed Beds with Cyanogas Calcium Cyanide." The lands must be kept free from all weeds which caterpillars may feed on, and it is well not to have maize, tomato and Cape gooseberries near the lands; a clearing of some depth is advisable, which must be regularly weeded. If poisoned bait is put down, it has been found that a covering of sacking

or leaves will help to retain moisture and thus give further attraction, especially at this time of the year. In order to lessen the heavy infestation of caterpillars and other insect pests in the seed beds, coverings of hessian or cheese cloth should be kept over beds, especially at night; cutworm moths are nocturnal in habit, so that the coverings of the beds need to be moth-proof at night. Notwithstanding precautions in the covering of the beds, insects will enter, and after the emergence of the seedlings a weekly spraying should be carried out. Lead arsenate at the rate of 1½ ozs. (powder) or 3 ozs. (paste) in a 4-gallon petrol tin can be sprayed on the plants once a week to keep insect pests in check. Lead arsenate can be safely used with Bordeaux mixture, the constituents not reacting upon one another. The two combined sprays act as a preventative and deterrent to insect and fungoid troubles.

Cotton.—Thorough cultivation and keeping down of weeds should be resorted to in order to lessen the infestation of over-wintering pupæ, by exposure to the sun, and birds.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder), 1 lb. to 30 gallons of water; or (paste), 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb.; fresh water-slaked lime, 20 lbs. For cabbage aphis, water liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphis (green fly) is troublesome, the plants may be sprayed with soap wash or tobacco wash. Leaf-eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started, the damage is negligible.

Citrus.—All out-of-season fruit should be removed by this time. Destroy all fruit "struck" by the false codling moth. Aphis may be controlled by very careful spraying with the combined "Lime-Sulphur-Nicotine" spray (for details see "Rhodesia Agricultural Journal," Sept., 1926, page 871), while the yellow thrip may also be kept in check by this spray. Avoid using miscible oils for citrus spraying. A careful search should be made for the American bollworm ("Heliothis obsoleta").

Deciduous Fruit Trees, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste), 1 lb. to 10 gallons of water, or (powder), 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is most essential, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation. Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and maize may also be sown this month.

FORESTRY.

The main sowings of Eucalypt (gum) seed should be made either in seed trays or in well prepared seed beds. A well-broken soil forming a fine tilth in the seed bed ensures more successful germination and better plants. If transplants are being used, any seedlings which are ready should be pricked out.

Seedlings in open beds may have their tap roots cut so as to develop fibrous lateral roots, and thus produce good type stocky plants. Remember the plant feeds through its roots, hence the better the root system, the healthier the plant and the greater its chances of successful establishment. If conditions are favourable, cross-plough and harrow land for planting broken up in early autumn.

POULTRY.

October is usually a hot month, and poultry keepers should therefore see that their birds have access to shade during the day. At the same time they should have plenty of air. One often sees birds during hot weather sitting under dense bushes, which is almost worse than no shade at all.

All houses should be examined and, if necessary, repaired. It is advisable to repeat the caution that birds must have dry quarters.

Many poultry keepers do not realise the vital necessity of giving their birds especially the young stock, plenty of succulent green food during the hot weather. It should be cut up and placed in boxes or hoppers about 7.30 a.m. and 5 p.m., and, if very hot, also at noon; it should never be placed in the sun. As much as the birds will eat should be supplied. Lack of it, especially during hot weather, causes a reduced output of eggs, smaller eggs and light-coloured yolks; further, a disease known as "nutritional disease" is likely to affect the birds and cause deaths. The symptoms are much like those of eye roup, without the well-known offensive smell of roup. It is due to the fact that vitamine A, which is present in large amounts in all succulent green foods, and which is so necessary for nutrition, is lacking. There is no doubt that many chickens and fowls die each year from this cause.

Ducks.—These during the hot weather require even more shade than do fowls; they cannot stand the direct rays of the sun nor sultry heat. The houses should always have dry floors, and should be overhauled before the rains commence. Ducks sleeping on damp floors often contract rheumatism and cramp. The floor of the duck house should be raised a few inches, thus ensuring a dry bed.

As many ducklings should be hatched as possible now, provided, of course, there is the prospect of a sale for them at ten weeks old. They thrive best in the wet weather.

Turkeys.—Stop hatching until after the wet season is over. To rear turkeys in the wet weather entails a good deal of time, labour, expense and often losses. Once a young turkey chick gets wet, it will probably die; at any rate it will never be the same bird it would have been had it not got wet. Give the older turkeys all the range possible; the further afield they go, the better grown birds they become, and less is the expense of feeding. See also that their roosting quarters are water-tight before the rains commence.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded if this has not already been done, and care should be taken that they do not suffer any serious setback by reason of want of feed. The question of a mineral mixture should receive consideration.

Sheep.—If spring lambs are expected, one should see that the sheep-shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the event of late rains. All drinking places should be cleaned out, and care taken that the water supply is sufficient. Ewes for winter lambing should be well looked after, so as to get them up in condition before they are put to the ram next month. General shearing may start, including the April-May lambs.

TOBACCO.

Continue to sow seed beds. Where grass has been put on the seed beds to assist germination of seed a daily inspection should be made, and as soon as the first few plants make their appearance the grass should be raised up a little from the bed in order to prevent the plants growing "spindley." All possible preparation for the coming planting season should be made.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot, dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

The normal rainfall varies from three-quarters of an inch to an inch in the different portions of the country. The rain usually occurs in the form of thunder-showers, which are not long sustained and are fairly local, but the total rainfall experienced during the month does not vary much over the whole country, with the exception of the eastern border, where the rainfall is usually heavier.

November.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally, where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required, artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour, use the disc harrow or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however,

on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boiling water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenite of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying land. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (heteronychus), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover over with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well

hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphis may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to do excellently in this Colony:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox, Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkin, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used.. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult, come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to

fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold; give them free range and feed them well, with at least one feed of soft food mixed with milk once a day. Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value. If normal rains have fallen, the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

TOBACCO.

Continue to sow seed beds, watering, etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery, gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

Southern Rhodesia Weather Bureau.

AUGUST, 1931.

Pressure.—Barometric pressure was generally above normal; the highest pressure was recorded in the south-west and the lowest in the north and east.

Temperature.—Temperature was generally well above normal over the whole country. The sunshine recorded at Salisbury was very nearly 100 per cent. This month was the most cloud-free on record.

Rain.—Three light showers were recorded on the eastern border.

AUGUST, 1931.

Station.	Altitude	Pressure 8.30 a.m.	Temperature ° F.						Humidity, 8.30		Precipitation.		
			Absolute.		Mean.			Diff. from Normal.	Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min.						
Bulawayo ...	4,440	873 0	89.4	40.0	79.6	47.3	64.0	+2.9	50.1	39	...	...	...
Gwelo	4,632	863.4	88.0	37.0	79.1	45.6	62.4	+2.6	51.9	45	...	−0.1	...
Riverbank ...	4,100	...	95.0	37.0	85.4	46.8	66.1	+2.8	49.9	45	...	...	...
Essexvale ...	3,828	...	94.0	34.0	85.9	42.1	64 0	+3.2	50.2	73	...	...	...
Gwanda ...	3,235	911.5	96.0	35.0	82.7	45.3	64.0	...	51.0	46	...	−0.1	...
Mazunga ...	1,970	953.8	98.0	40.3	86.5	44.9	65.7	+0.9	...	...	...	−0.2	...
Nuanetsi ...	1,630	...	99.0	39.0	84.4	43 9	64.2	...	58.2	86	...	...	...
Between Rivers	3,970	...	91.2	36.4	84.5	43.3	63.9	...	51.0	60	...	...	...
Enkeldoorn ...	4,720	...	88.0	40.0	79.1	46.6	62.9	+2.6	51.5	46	...	...	...
Gatooma ...	3,850	...	92.0	41.0	83.2	46.1	64.7	+0.3	52.3	43	...	...	...
Miami	4,090	...	87.0	43.0	77 8	48.6	63 2	...	53.9	46	...	...	...
Salisbury ...	4,865	859.0	87.2	40.8	77.3	47.8	62.6	+2.6	50.1	43	...	...	...
Sinoia Citrus ...	3,830	...	84.0	39.0	76.7	45.6	61.2	...	51.2	51	...	...	...
Sipolilo... ...	3,900	...	87.0	42.0	78.3	51.2	64.8	+0.5	53.6	44	...	...	...
Juliasdale ...	6,070	...	81.0	37.7	69.8	43.5	56.7	+2.8	50.3	40	...	−.03	...
Mtoko	4,210	...	85.0	45.0	75.8	52 0	63.9	...	53.3	50	...	...	...
Shamva ...	3,170	...	92.0	40.0	81.4	45.4	63.4	−0.4	54.4	59	...	...	...
Angus Ranch ...	2,300	...	98.0	47.0	83.5	52.4	68.0	...	53.9	56	...	...	...
Craigendoran ...	3,430	...	96.0	41.0	83.9	48.6	66.3	...	56.6	55	...	−.01	...
New Year's Gift	2,700	...	94.2	45.5	81.3	50.8	66.1	...	52.7	56	...	−.01	...
Nyamasanga ...	5,080	...	77.0	34.0	65.3	39.4	52.4	...	49.5	58	...	...	...
Riverdene North	3,700	...	93.0	32 0	82.1	39.6	60.9	+1.5	49.8	62	...	−.01	...
Stapleford ...	5,450	...	...	...	...	...	...	...	...	...	...	−.06	...
Umtali	3,677	897.8	90.0	41.0	76.3	49.2	62.8	+0.8	54.9	56	...	−.02	...
Victoria ...	3,570	900.8	92.0	36.0	77.8	43.2	61.0	+1.8	50.7	53	...	−.01	...
Melsetter ...	5,060	854.6	86.0	41.0	74.5	48.4	61.5	+3.6	52.8	43	...	−.03	...
Mount Selinda	3,520	...	90.0	43.0	75.6	50.5	63.1	+3.4	55.3	51	0.02	−.07	1

Southern Rhodesia Veterinary Rep

JULY, 1931.

AFRICAN COAST FEVER.

Melsetter District: The slaughtering of the infected herds was completed.

Salisbury District: One case occurred at the infected farm Lorelei.

FOOT AND MOUTH DISEASE.

This was the subject of a special report in the September issue of the *Rhodesia Agricultural Journal.*

SNOTZIEKTE.

In the Chilimanzi district two head of cattle showed typical symptoms of this disease, and biological tests carried out by the Director of Veterinary Research were confirmatory. The existence of this disease in various parts of the Colony has been suspected for several years, but this is the first definite diagnosis.

TUBERCULOSIS.

Post-mortem examination of a bull on a farm in the Chilimanzi district showed, in addition to the more common lesions, a tubercular ostitis of the dorsal vertebræ.

TRYPANOSOMIASIS.

A slight mortality in cattle reported from the Melsetter and Hartley districts.

IMPORTATIONS.

From the Union of South Africa: Bulls, 5; cows, 15; horses, 11; donkeys, 88; sheep, 2,630; goats, 66.

EXPORTATIONS.

Nil.

AUGUST, 1931.

AFRICAN COAST FEVER.

Salisbury: Four cases occurred on the infected farm Lorelei.

FOOT AND MOUTH DISEASE.

Chibi District.—A fresh outbreak occurred on Tokwe Block on the northern boundary of this district and adjoining the Selukwe district, and the disease has spread to that portion of the Lundi Reserve in this district, also on the Crown land north of Mashaba-Shabani road. One area cleared up.

Gwanda District.—Several extensions of infection occurred on Liebig's Ranch. A fresh outbreak occurred on a farm on the Bubye River, a few miles from the northern boundary of Liebig's Ranch.

Victoria District.—Seven new outbreaks in the Mashaba and Zimbabwe areas. The disease has been very slow in spreading in some of the infected areas, especially in the Zimutu and Victoria Reserves. Seven areas cleared up.

Chilimanzi District.—One fresh outbreak. Most of the previously infected centres are now cleared up.

Charter District.—One fresh outbreak. All previously infected centres are now cleared up.

Gwelo.—One fresh outbreak. With two exceptions all previously infected centres are now cleared up.

Selukwe.—Three fresh outbreaks in the south-eastern portion of the district adjoining infected areas in the Victoria and Chibi districts.

Belingwe District.—The north-eastern section of the district, including the Shabani area and the Lundi Reserve, is now free from infection. Fresh outbreaks occurred on the Belingwe Native Reserve and the farm Springs.

Insiza District.—Two fresh outbreaks occurred in this district in the immediate vicinity of infection in the Belingwe district.

Umzingwane District.—An outbreak occurred in the immediate vicinity of the original outbreaks in Bubi district.

Bubi District.—Although several fresh outbreaks occurred in the south-eastern section of this district, infection has not passed through the original cordon placed around this area.

Salisbury District.—At two of the four centres infected in the first instance, the disease passed rapidly through the herds, and by the end of the month all animals had recovered completely and the trek oxen were all at work again. At the other two infected centres, one of which is the Salisbury Commonage, the progress of the disease was somewhat slow, but the majority of the animals involved are now infected and recovering rapidly. The northern and eastern sections of the Commonage have so far not become infected.

Three fresh outbreaks occurred, all in the immediate vicinity of previously infected areas. In two of these it is believed that the infection was carried in the Gwebi River.

Mazoe District.—At the centres infected in the first instance the disease passed rapidly through the herds without any mortality. Two native kraals in the Chiweshe Reserve became infected.

TRYPANOSOMIASIS.

There has been an increase in diagnosed cases in the Melsetter district, especially along the eastern border, where eight farms were involved. Treatment is giving good results in many cases. A few cases have also been recorded in the Wankie and Hartley districts.

SCAB.

Several infected flocks have been dealt with.

IMPORTATIONS.

From the Union of South Africa: Bulls 6; cows and calves, 77; heifers, 6; horses, 54; donkeys, 48; sheep, 1,855; goats, 140.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Gwebi Produce Prices.

Salisbury White, seed maize ...	42/- per bag of 200 lbs.
Salisbury White, seed maize (tips and butts)	15/- per bag of 200 lbs.
Hull-less oats	40/- per bag of 150 lbs.
Spanish Bunch nuts (unshelled)	15/- per bag of 75 lbs.
Spanish Bunch nuts (shelled)	60/- per bag of 180 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Majorda seed	1/1 per lb.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

Notes from the "Gazette."

"Gazette" Date.	*Items.*
	ADVANCES ON MAIZE.
21.8.31.	The Land and Agricultural Bank of Southern Rhodesia is making the following advances against cession of Maize Participation Certificates issued by the Maize Control Board:— On Classes A, A1, B, B1, C, C1 ... per bag 5/- On Classes D, D1 ... ... per bag 4/6 On Class E ... ... per bag 3/6 On inferior maize accepted by the Maize Control Board ... ... per bag 3/6
	GAME AND FISH PRESERVATION ACT, 1929.
28.8.31	The under-mentioned areas are game reserves, and it is not lawful to hunt game therein without the special permission in writing of the Minister of Agriculture and Lands:— (a) The Chikwizo Native Reserve, Mtoko district. (b) An area in the Lomagundi district bounded on the east by the Portuguese border; on the north by the Zambesi River; on the west by the Mwanja River to its headwaters by a direct line from these headwaters to the headwaters of the Manyimu River, and the Manyimu River; on the south by the Manyimu and Angwa Rivers. The provisions of sections 3 and 6 of the Act are suspended in respect of all classes of game mentioned in Parts "A" and "B" of the first Schedule to the said Act within the reserves aforesaid. (G.N. No. 34.)
	MAIZE ACT, 1925.
18.9.31.	Government Notice No. 573 prescribes White Dent maize as the maize which shall be grown within a specified area in the Lomagundi district.
	IMPORTATION OF CATTLE FROM NORTHERN RHODESIA.
18.9.31.	Government Notice No. 574 contains provisions governing the above. Briefly, importation must be by rail only, and each consignment must be accompanied by a permit from the Controller of Stock or Chief Inspector. All cattle imported have to be examined at Bulawayo, or elsewhere as directed. All expenses or losses incident to quarantine, examination, testing or destruction have to be borne by the owner of the cattle.
	IMPORTATION OF LIVE STOCK INTO SOUTHERN RHODESIA.
18.9.31.	A slight amendment has been made to the regulations. It is now necessary, prior to importation, to apply for the necessary permit to the Veterinary Department at Bulawayo or Salisbury. (G.N. No. 34.)

Sales.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (Blades), Algerian Variety: 20 slabs, 5s.; 50 slabs, 10s.; 100 slabs, 17s. 6d.

Stocks are limited, and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns: 10 crowns, 5s.; 20 crowns, 7s. 6d.; 50 crowns, 15s.; 100 crowns, 25s.

Delivery during October for irrigated land, and in January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December. The prices are for delivery free at purchaser's nearest station or siding in Southern Rhodesia. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 581. Leguminous Crops for Stock and Soil Improvement in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 603. The Production of Maize in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.
No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.
No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.
No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).
No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.
No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.
No. 724. Ploughing by Tractor, by A. W. V. Crawley, M.E., F.G.S.
No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.
No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.
No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.
No. 750. Cotton in Southern Rhodesia—Hints to Growers, by G. S. Cameron, Empire Cotton Growing Corporation.
No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 757. Maize on the Sand Veld : Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.
No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.
No. 759. Witch Weed (Striga Lutea) : Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.
No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).
No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.
No. 777. Some Aspects of Cost of Production Studies in Agriculture, by Arthur G. Ruston, D.Sc., Department of Agriculture, Leeds University.
No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.
No. 783. Agricultural Costings at the Gwebi Farm—Fattening for Beef, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.
No. 794. Some Further Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.
No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.
No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.
No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.
Botanical Specimens for Identification.
Accelerating the Sprouting of Potatoes.
Further Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron, Cotton Specialist.

REPORTS ON CROP EXPERIMENTS.

No. 94. Second Report on Experiments, by J. H. Hampton.
No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
No. 239. Reports on Crop Experiments, Gwebi, 1915-16, Part I., by E. A. Nobbs, Ph.D., B.Sc.
No. 246. Report on Crop Experiments, Gwebi Farm, Season 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
No. 342. Rotation Experiments, 1913-19, by H. G. Mundy, F.L.S., and J. A. T. Walters, B.A.
No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-20.
No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.
No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.
No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.
No. 437. Annual Report of Crop Experiments, Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.
No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 485. Annual Report of Experiments, 1922-23, Agricultural Experiment Station, Salisbury, by J. A. T. Walters, B.A.
No. 486. Bulawayo Experiment Station, Annual Report for Season 1922-23, by H. G. Mundy, F.L.S.
No. 514. Bulawayo Experiment Station Report, 1923-24, by H. G. Mundy, F.L.S.
No. 519. Annual Report of Experiments, 1923-24, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.

No. 537. Crop Rotations on the Gwebi Experiment Farm, 1923-24, by H. G. Mundy, Dip.Agric., F.L.S.
No. 564. A Maize Rotation Experiment, by A. R. Morkel.
No. 566. Bulawayo Experiment Station, Annual Report for Year 1924-25, by H. G. Mundy, Dip.Agric., F.L.S.
No. 608. Annual Report of Experiments, 1924-25, Agricultural Experiment Station, Salisbury, by H. G. Mundy, Dip.Agric., F.L.S.
No. 631. Bulawayo Experiment Station: Annual Report for Year 1925-26, by H. W. Hilliard.
No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.
No. 675. Bulawayo Experiment Station—Annual Report for Year 1926-27, by D. E. McLoughlin.
No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.
No. 688. Report, 1923-24—1926-27, Gwelo Municipal Demonstration Stations, by D. E. McLoughlin.
No. 716. Report, 1927-28, Gwelo Municipality Demonstration Stations, by S. D. Timson, M.C., Dip.Agric.
No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.
No. 767. Gwelo Municipal Demonstration Stations. Annual Report for the Season 1928-29, by D. E. McLoughlin.
No. 773. Bulawayo Municipal Demonstration Station: Report for the Seasons 1927-28 and 1928-29, by D. E. McLoughlin, Assistant Agriculturist.
No. 789. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, 1928-29, by H. C. Arnold, Manager.
No. 800. Bulawayo Municipal Experiment Station: Report for the Season 1929-30, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 806. Gwebi Demonstration Farm, by the Chief Agriculturist.
No. 810. Gwelo Municipal Demonstration Station: Annual Report, 1929-30, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.
No. 830. Salisbury Agricultural Experiment Station, Annual Report, 1929-30, by H. C. Arnold, Manager.

TOBACCO.

No. 605. Flue-curing Tobacco Barns, Bulking and Grading Sheds, by P. H. Haviland, B.Sc. (Eng.), Acting Government Irrigation Engineer.
No. 615. The Culture of Virginia Tobacco in Southern Rhodesia—Field Management, by D. D. Brown.
No. 617. Dark Fire-cured Tobacco, by E. M. Matthews, B.Sc., Tobacco Adviser. Fire-curing Tobacco Barn, by the Tobacco Advisers.
No. 641. The Handling, Grading and Baling of Cured Virginia Tobacco, by D. D. Brown.
No. 644. Tobacco Baling Boxes, by B. G. Gundry, Irrigation Branch.
No. 653. The Care of Tobacco Seed Beds, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).
No. 661. Flue-curing Tobacco Barns, 12 ft. x 12 ft. x 16 ft., by B. G. Gundry.
No. 665. Tobacco Pests of Rhodesia, by Rupert W. Jack, F.E.S., Chief Entomologist.
No. 671. Wildfire and Angular Spot of Tobacco, by J. C. F. Hopkins, B.Sc., A.I.C.T.A.
No. 679. Tobacco Culture in Southern Rhodesia: The Harvesting and Curing of Virginia Tobacco, by D. D. Brown.
No. 689. The Lesser Tobacco Wireworms, by Rupert W. Jack, F.E.S.
No. 715. Turkish Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.

No. 718. Preliminary Experiments on the Control of White Mould of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
No. 728. Suggested Crop Rotations for Tobacco Growers, by D. D. Brown, Chief Tobacco Expert.
No. 734. Common Faults in Curing Virginia Bright Tobacco, by D. D. Brown, Tobacco and Cotton Expert.
No. 746. The Development of the Tobacco Industry in Southern Rhodesia. A Historical Survey, by D. D. Brown, Chief Tobacco Expert.
No. 748. Frog Eye Disease of Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
No. 753. Leaf Spotting of Tobacco caused by Mosaic, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Mycologist.
No. 765. Seasonal Notes on Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Expert.
No. 771. Dark Fire-cured Tobacco: Field Operations, by D. D. Brown, Chief Tobacco Expert.
No. 774. Dark Fire-cured Tobacco: Harvesting and Curing, by D. D. Brown, Chief Tobacco Expert.
No. 779. Mycological Notes—Further Experiments on the Control of White Mould (Erysiphe Cichoracearum DC.) of Tobacco, 1927-28, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
No. 784. Field Control of Frenching in Tobacco, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A., Plant Pathologist.
No. 812. Selection of Tobacco Seed Plants, by H. F. Ellis, M.Sc., B.Sc. (Agr.), Tobacco Adviser.
No. 828. Seed-Beds, by D. D. Brown, Chief Tobacco and Cotton Expert.
Handbook of Tobacco Diseases in Southern Rhodesia, by J. C. F. Hopkins, B.Sc., A.I.C.T.A. Price 3/6 post free from Accountant, Department of Agriculture, Salisbury.

STATISTICS.

No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
No. 247. Statistical Returns of Crops Grown by Europeans in Southern Rhodesia for the Season 1915-16, by E. A. Nobbs, Ph.D., B.Sc., and Fred Eyles, F.L.S.
No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
No. 361. Statistics of Live Stock and Animal Produce for the Year 1919, by F. Eyles, F.L.S.
No. 380. Statistics of Crops Grown by Europeans in Southern Rhodesia, 1919-20, by H. C. K. Fynn.
No. 393. Statistics of Live Stock and Animal Produce for 1920, by H. C. K. Fynn.
No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1920-21, by H. C. K. Fynn.
No. 426. Statistics of Live Stock and Animal Products for the Year 1921, by H. C. K. Fynn.

No. 484. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1922-23, by A. Borradaile Bell.
No. 527. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1923-24, by A. Borradaile Bell.
No. 543. Statistics of Live Stock and Animal Products for the Year 1924, by A. Borradaile Bell.
No. 580. Statistics of Summer Crops Grown by Europeans in Southern Rhodesia for the Season 1924-25, by A. Borradaile Bell, Statistician.
No. 595. Statistics of Live Stock and Animal Products for the Year 1925, by A. Borradaile Bell, Statistician.
No. 626. Statistics of Summer Crops Grown by Europeans in Southern Rhodesia for the Season 1925-26, by A. Borradaile Bell, Statistician.
No. 646. Statistics of Live Stock and Animal Products for the Year 1926, by A. Borradaile Bell, Statistician.
No. 682. Agricultural Returns for 1926-27: Preliminary Returns, by Thomas G. Gibson, Government Statistician.

LIVE STOCK.

No. 227. An Experiment in Beef Production, by R. C. Simmons.
No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
No. 336. Butchering and Flaying.
No. 338. From Breeder to Butcher; Beef Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
No. 421. From Breeder to Butcher; Cattle Feeding Experiment No. 9, Government Experiment Farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.
No. 446. From Breeder to Butcher; Cattle Feeding Experiment No. 11, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.
No. 468. From Breeder to Butcher; Cattle Feeding Experiment No. 13, by Eric A. Nobbs, Ph.D., B.Sc.
No. 483. From Breeder to Butcher; Cattle Feeding Experiments Nos. 14 and 15, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc.
No. 584. Merino Sheep in Southern Rhodesia, by H. W. Hilliard.
No. 624. The Construction of Dipping Tanks for Cattle (Revised).
No. 701. Feeding Bullocks at Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 719. Hand-rearing of Calves (Revised), by T. Hamilton, M.A., N.D.A., N.D.D., Dairy Expert.
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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

Umvuma-Enkeldoorn Wheat Exhibition, 1931.—It will be remembered that a very successful wheat exhibition was arranged at Enkeldoorn a year ago. Steps are now being taken to organise the second annual exhibition, to be held at Umvuma probably early in December this year. Full details, including the exact date of the exhibition, will be published in the daily Press.

The Tobacco Push.—Further good work in making known and creating a demand for Rhodesian tobacco was done by our High Commissioner at Southend during the Empire Shopping Week, which was held in conjunction with the annual carnival from the 26th to 29th August. The stand allotted to Southern Rhodesia was very favourably situated,

and was visited by a large number of people. A special feature was made of the exhibit of over 1,600 lbs. of different types of leaf, in addition to numerous brands manufactured wholly or partly from Rhodesian tobacco. Judging from a photograph sent us a very effective display was made which was the subject of much favourable comment and resulted in a considerable sale of samples. In accordance with experience at Glasgow, Plymouth, Blackpool and other places where Southern Rhodesia has exhibited this year, the principal wholesale and retail tobacco dealers report that the demand for Rhodesian tobacco and cigarettes has increased materially in consequence of the display, and they have promised to co-operate in further popularising our product by making special shop window displays from time to time.

That the work is bearing fruit is shown by the following extract from a letter written by the managing director of the largest wholesale tobacconists in Essex: "There is a rapidly growing demand for Empire tobaccos, which proves the wisdom of a preference duty, followed up as it is by a strong publicity campaign."

South African Farmers' Tour of Great Britain.—We publish elsewhere in this issue of the Journal some impressions gained by Mr. D'Urban Barry, of En Avant, Umtali, during his tour of Great Britain with the party of South African farmers. The tour was arranged by the British National Union, which was founded by the late Sir Pieter Bam in 1925, and the party numbered 30 in all. The farmers were representative of every Province of the Union of South Africa and Rhodesia, and their interests covered a wide range of activities from general and stock farming to wattle, fruit and sugar production. The tour covered a period of two months, during which the party travelled by motor coach some 3,500 miles, exclusive of journeys by motor cars that were placed at their service at different points by local farmers, who, as is usual on such occasions, did everything possible to welcome the visitors and make them feel at home. We are informed that one and all of the tourists brought back with them favourable impressions, not only of the high standard of British agriculture in all its varied forms, but

of the kindness and goodwill that the people of Great Britain bear to those of other parts of the Empire. It is to the personal contact and friendship engendered by these visits that the greatest value of the tours attaches, and we are pleased to learn that no greater success has been attained in this direction than on the present occasion.

It may be of interest to mention that on 4th June, 1931, the total area in England and Wales under all crops and grass, exclusive of rough grazing, was 25,278,000 acres. The area of arable land was 9,582,000 acres, of which 1,197,000 acres were under wheat, 1,029,000 under barley and 1,652,000 acres under oats. The total number of cattle on agricultural holdings on the date mentioned was 6,064,300, of which 2,042,500 were cows and heifers in milk. The number of sheep totalled 17,745,400, pigs 2,777,700 and horses 938,400.

The United States Tobacco Export Trade.—According to "Tobacco," the American trade journal, exports of leaf tobacco from the United States during the seven months period of 1931 totalled 292,264,738 lbs., with a return of 55,965,053 dollars. The volume was approximately 42,000,000 lbs. in excess of the quantity exported during the like period of 1929, and 4,325,000 lbs. over the same period of 1930. Values, on the average, however, were less by 4.37 and 2.07 dollars per hundred lbs. for the respective years, the 1931 average being 19.15 dollars. Bright flue-cured exports held first place with practically 69 per cent. of the total volume and 75 per cent. of total value. The average price of this type of tobacco was 20.84 dollars per 100 lbs. The United Kingdom paid an average of 40.07 dollars per 100 lbs., and her takings were 54,478,509 lbs. Japan bought 9,499,380 lbs. at an average per hundred of 28.82 dollars. Canada took 6,981,093 lbs. at 21.33 dollars. Australia paid an average of 17.51 dollars for 10,693,156 lbs.; Germany, 12.38 dollars for 5,318,574 lbs.; Java and Madura, 14.96 dollars for 4,033,021 lbs.; Belgium, 8.30 dollars for 2,144,104 lbs.; Netherlands, 11.89 dollars for 3,513,517 lbs.; and Spain, 7.91 dollars for 3,386,741 lbs. China far exceeded the takings of the United Kingdom, with a total of 88,626,733 lbs. The

average price paid by China was 10.05 dollars. Of the countries named, only three decreased purchases when compared with the 1930 period, namely, Australia, Canada and Java and Madura. Exports of manufactured tobacco products from the United States decreased during the seven months period of 1931 as compared with like periods of 1930 and 1929. Cigarettes suffered heavily and registered decreases of 1,625,236,000 and 3,743,391,000 when compared with the respective periods. Conditions prevailing in China account, in a very large measure, for the decrease. The situation is counteracted, however, by increased exports of leaf tobacco to that market.

The Tobacco Research Station.—Owing to the necessity of a reduction of expenditure on the activities of the Department of Agriculture, it has been decided to close down a considerable part of the work in progress on the Research Farm, Marandellas. Operations will be suspended indefinitely on the commercial demonstration section, the experimental section and the tobacco research section.

The pasture research section, for the maintenance of which a grant-in-aid is received from the Empire Marketing Board, will be somewhat extended, and experiments with improved pasture grasses and clovers on vlei soils will be included in the operations on this section.

The tobacco research work commenced at Marandellas will be transferred to the Tobacco Experiment Station, Salisbury, where it can be better and more economically carried out, and this institution in future will be known as the Tobacco Research Station. Much of the general field experimental work which has been in progress on this station for the past five years will be discontinued in order to permit of greater concentration on strictly tobacco problems, and the apprentices in training have already been transferred to the Matopo School of Agriculture, where for the present instructional work of this nature will be carried on. Mr. C. Kelsey Harvey, late manager of the Tobacco Experiment Station, has proceeded to the Matopo School to take special charge of the students and apprentices there and of experimental work. Mr. H. F. Ellis, Assistant Tobacco

Adviser, will be the resident officer in charge of the Tobacco Research Station, Salisbury, where Mr. T. K. Sansom, the Plant Breeder, will also be stationed.

In view of the discontinuance of many of the more general crop experiments which have been in progress on the Tobacco Experiment Station during the past five years, a report on the results of these up to the present time appeared in the last Journal and is continued in the present issue.

The Rhodesia Agricultural Union Congress.—A considerable amount of good work was accomplished at the annual congress of the Rhodesia Agricultural Congress, which was held in Salisbury on the 30th September and subsequent days. Not the least important matter before congress was the resolution submitted by the Mashonaland Farmers' Association, which called for a vote of confidence in the work of the R.A.U., and expressed the intention of maintaining the organisation in a state of efficiency. It is most unfortunate that of late the parent body has not received the support financially and morally from the affiliated associations that it should, and in consequence has been stultified in the work it has sought to perform. The action of the Matabeleland farmers in forming a separate union must rob the Rhodesia Agricultural Union of much of its prestige and lessen its influence in speaking and acting as the mouthpiece of the farmers of the Colony. It is pleasing to note that congress unanimously adopted the resolution submitted by the Mashonaland Farmers' Association, and also decided to make a very special effort to bring Matabeleland farmers back into the fold of the R.A.U. We trust that the attempt will be successful and that this long established body will once again be thoroughly representative of all sections of the agricultural industry. There never was a time when it was more necessary for farmers to stand shoulder to shoulder to meet common difficulties than the present, and any action which tends to weaken unanimity of purpose is greatly to be deplored.

The Executive having come to the conclusion that the voluntary assessment plan for financing the R.A.U. had broken down submitted certain far-reaching proposals of

reorganisation based on the formation of commodity associations, which would provide the necessary funds by means of a levy on the principal products sold. This resolution occupied congress a considerable time, and the decision to refer the whole matter to a special congress to be held after the next session of the Legislative Assembly will give associations time to examine the proposals carefully and to decide as to their practicability and general effect. It is obvious that something must be done to ensure the necessary funds, and we have no doubt that now the seriousness of the position is fully realised, some satisfactory solution will be found.

There were numerous other matters of importance dealt with by congress, and we intend to publish from time to time in this Journal comments on the resolutions adopted. As usual, the general standard of debate was on a high level, and it was pleasing to note the intelligent and active part which some of the younger members of the agricultural community took in the proceedings. This is all to the good and we see in these younger men worthy successors to those who have borne the heat and burden of the day for so long.

It was fitting that a special resolution was passed by congress in recognition of the unsparing, unselfish and splendid services rendered by Mr. H. B. Christian during his term of office as president of the R.A.U. It was decided to elect Mr. Christian an honorary life vice-president of the Union, an action which received the enthusiastic support of all delegates, and will meet with the unanimous approval of farmers throughout the Colony, whether members of the affiliated associations or not.

The Woodland Types of Southern Rhodesia.

(Concluded.)

By J. S. HENKEL, late Chief Forest Officer.

[*Coloured maps, showing the general distribution of the woodland types in Southern Rhodesia have now been published and if studied in conjunction with the preceding and following article, a comprehensive bird's-eye view of the Colony's vegetation may be obtained. The map is published in two sizes. The larger is more elaborate and includes roads and contours as well as a detailed table of the main associates of the several vegetation types. Copies are available from the Chief Forest Officer, Department of Agriculture, Salisbury, at the following prices: Small map, scale 32 miles to an inch, at 2/6 each. Large map, scale 18 miles to an inch, at 8/6 each.*—Ed.]

In the preceding part of this article a general description of the Colony's woodland was given, and the first of the two main groups, viz., Closed Forest, was described.

B. Open Forest or Tree-veld.

The tree-veld covers the rest of the Colony. The constituent species of the tree-veld are often mixed to such a degree that it is difficult, in numerous localities, to determine which should be considered the dominant ones.

For purposes of the classification of types of tree-veld, altitude, which is the dominant factor, has been taken to

indicate the various zones where certain species are most numerous and characteristic. The tree-veld may be subdivided into eight main associations or types, viz.:—

1. (a) Muhatja (*Parinarium mobola*).
   (b) Mangwe (*Terminalia sericea*).
   (c) Thorn (*Acacia spp.*).
2. Mahobohobo (*Uapaca kirkiana*).
3. (a) Msasa (*Brachystegia randii*).
   (b) Umgusu (*Baikiaea plurijuga*).
4. Mfuti (*Brachystegia woodiana*).
5. Mopani (*Copaifera mopane*).

Types 1 (a) to 3 (b) may be considered the high veld, type 4 the middle veld and type 5 the low veld.

Type 1 (a) Muhatja (*Parinarium mobola*).—The uppermost type, embracing the watershed and main plateau, is characterised by the dominance of *Parinarium mobola* (Muhatja or Mujakata or Umkunu, as the tree is commonly known); *Protea abyssinica* (Sugar bush) and *Faurea saligna* (Beukenhout). Associated with this type are the large grassland areas noted when travelling along the railway between Bulawayo and Umtali. *Parinarium mobola* frequently occurs as a large evergreen tree with a wide spreading crown. The frequency of the occurrence of the type on the plateau or high veld in Mashonaland, its decreasing abundance westwards and its occurrence over wide areas in the eastern middle veld associated with other species, suggests the idea that this type was once dominant over very considerable areas and it has been invaded by faster growing species migrating from the east or north-eastern direction. Associated with this type are such trees as *Uapaca kirkiana*, *Monotes spp.*, *Strychnos spp.*, *Faurea saligna*, *Faurea speciosa*, *Cussonia spp.*, *Brachystegia randii*, *Berlinia globiflora*, *Acacia spp.*, *etc.* *Eugenia owariensis* (Mukute dombo) frequently fringes the muhatja type, where it adjoins vleis.

A group in many respects very striking in its character is that of the Mountain Acacia (*Brachystegia tamarindoides* or *filiformis*). This tree occurs on rocky kopjes and stony places throughout the eastern and middle portions of the Colony, extending as far west as Fort Usher. The tree occurs on many of the highest kopjes and descends to low

elevations. It is generally gregarious, but on the edges of the kopjes it merges into the associates of the zone in which the kopjes occur. It is possible that this tree is one of the earliest invaders, and competition has forced it to occupy areas of shallow rocky soil where other species cannot thrive.

Type 1 (b). Mangwe (*Terminalia sericea*).—The altitude and geological formation of the main plateau which extends from Plumtree to beyond Salisbury show no striking differences between the south-western and north-eastern extremities. The rainfall, however, in the south-west is only 20 to 25 inches, as against 30 to 40 inches in the north-east. On account of this lower rainfall in the south-west other species become dominant. In this lower rainfall zone, on the granites and gneisses, which, generally give rise to acid soils, the mangwe (*Terminalia sericea*) is dominant.

The type is very mixed, but the mukarati (*Burkea africana*) is nearly always found in association and in some localities it may be more abundant than the mangwe. Associates of these two trees are the following: *Peltophorum africanum*, *Sclerocarya caffra*, *Rhus lancea*, *Rhus viminalis*, *Bauhinia articulata*, *Protea abyssinica*, *Faurea saligna*, *Dombeya rotundifolia*, *Bolusanthus speciosus*, *Lannea discolor*, *Heeria insignis*, *Combretum rhodesicum*, *Combretum spp.*, *Albizzia amara*, *Ficus capensis*, *Vitex sp.*, *Combretum petersii*, *Pseudolachnostylis maprouneæfolia*, *Zizyphus mucronata*, *Pterocarpus sericeus*, *Commiphora spp.*, *Acacia spp.*; *Kirkia acuminata*, *Pterocarpus angolensis*. The shrubs *Euclea lanceolata*, *Carissa tomentosa*, *Ormocarpum trichocarpum*, *Tarchonanthus camphoratus*, *Gymnosporia buxifolia* become more evident. In poorly drained areas mopani (*Copaifera mopane*) is frequent.

Type 1 (c). Thorn-veld (*Acacia spp.*).—In the lower rainfall areas of the south-western and middle portions of the main plateau, on the alkaline soils of the basement schists, various species of *Acacia* become dominant. This association is best developed in the neighbourhood of Bulawayo and along the road to the Matopo Park. The *Acacia* association is characterised by shallow soils and occurs as an interrupted belt of varying thickness extending from the western boundary of the Colony to the Charter district. The railway line between Bulawayo and Gwelo

crosses the belt at a number of places. Frequently met with in this belt are:—*Acacia benthami, Acacia karroo, Acacia mimosoides, Acacia rehmanniana, Acacia seyal, Acacia verek, Dichrostachys nutans, Albizzia amara, Bolusanthus speciosus, Rhus lancea, Sclerocarya caffra, Peltophorum africanum, Zizyphus mucronata, Combretum spp., Heeria insignis*, etc. The shrubs *Euclea lanceolata* and *Carissa tomentosa* are abundant within the type.

The typical thorn-veld trees are not as tall as those in other types, except in certain areas of the Kalahari sands in the north-west of the Colony, where the camelthorn (*Acacia giraffae*) is dominant as a large tree. In these areas dense thickets (sinangas) consisting of *Dichrostachys* and other species are abundant. *Acacias* of various species are frequently found on the black vlei soils throughout the Colony.

Type 2. Mahobohobo (*Uapaca kirkiana*).—The mahobohobo or muzhanzhi is widely distributed in the eastern half of the Colony, and occupies a zone next to the muhatja. It is found at its best in situations which are well watered and well drained, such as ridges at heads of valleys having eastern and southern aspects. It is sensitive to frost and the areas occupied by it are always frost-free. It is best developed on red, rocky soils, but frequently occurs on soils of granite origin. Mahobohobo is met with in pure forests almost close-type in character, with poor grass growth on the floor. It is semi-evergreen, evergreen in normally wet years and deciduous in years of low rainfall. Away from its optima conditions the tree appears on the eastern and southern slopes of kopjes as clumps or single trees associated with other species. On account of the abundant humus produced by the tree, natives are partial to the association, and considerable areas have been deforested. Typical localities occupied by the type are:—Selukwe Hills, Mavuradonna Mountains, lower eastern slopes of the eastern border range and numerous places in the Victoria, Ndanga, Bikita, Makoni and Lomagundi districts. The tree is vigorous, persistent and somewhat aggressive, and can ordinarily hold out against competitors.

In the same localities occupied by the mahobohobo the smaller species, *Uapaca nitida*, often occurs as an isolated tree.

In the colluvial soils at the base of rocky hills occupied by mountain acacia (*Brachystegia tamarindoides*) belts of mahobohobo are nearly always found.

Type 3 (a). Msasa (*Brachystegia randii*).—This type covers a large area widely spread in the eastern portions of the Colony. Its best development is within the 30 to 40-inch rainfall zone. Msasa is frequently associated with the mnondo (*Berlinia globiflora*). Sometimes the one, sometimes the other dominates, and not infrequently the one or the other occurs in pure stands. Both are aggressive, and the tendency is to kill all competitors. Of the two trees, the mnondo has the wider range upwards and downwards from its optimum. The type appears to be of north-eastern origin, and like two arms has spread up the middle and high veld on both sides of the main divide. South of the divide they thin out towards the south-west, but reach the Gwanda district. On the north side of the divide they reach the border of the Colony beyond Victoria Falls. These trees only occur on well-drained soils. Where moisture and temperature conditions are unfavourable—either soil or air—they assume scrub form, and, with increasing elevation, disappear, persisting, however, on western aspects. In optima conditions the trees attain heights of 60 feet with long, straight cylindrical boles up to three feet in diameter. The mnondo, however, never attains the dimensions of the msasa. These two trees are invading the upper groups.

Species associated with this type are *Parinarium mobola*, *Faurea saligna*, *Faurea speciosa*, *Peltophorum africanum*, *Bolusanthus speciosus*, *Pterocarpus angolensis*, *Monotes glaber*, *hypoleucus* and *africanus*, *Strychnos spp.*, *Swartzia madagascariensis*, *Burkea africana*, *Terminalia sericea*, *Terminalia robusta*, *Albizzia spp.*, *Uapaca kirkiana*, *Ochna spp.*, *Acacia spp.*, etc.

Where the type adjoins vleis it is frequently fringed by *Protea spp.*, *Bauhinia articulata*, *Terminalia sericea*, *Combretum spp.*, *Lonchocarpus capissa*, *Kigelia pinnata*, *Eugenia owariensis*, *Securidaca longipedunculata* and *Acacia spp.* *Parinarium* and *Eugenia owariensis* frequently occur on the edges of vleis as a low scrub only a foot or more in height.

Type 3 (b). Umgusu (*Baikiæa plurijuga*).—This type, though on a lower level and less well-watered, may be considered the north-western equivalent of the msasa (mahobohobo is absent in the north-west). The type is exclusively confined to the Kalahari sand formation. The chief associate of the umgusu is the umtjibi or Rhodesian mahogany (*Copaifera coleosperma*).

A careful study of the vegetation indicates that at one time the sand areas were covered by the *Parinarium-Protea* type; this type was replaced by umgusu and umtjibi, two trees apparently of north-western origin, and were at one time co-extensive with the whole present distribution of the Kalahari system except the outliers in the Gwelo and Chilimanzi districts.

The present type is being displaced by *Brachystegia randii*, *Berlinia globiflora* and *Brachystegia woodiana*. The line of advance of these species can easily be determined when traversing the sand areas.

In typical form umgusu is associated with:—*Pterocarpus angolensis*, *Gleditschia africana*, *Ricinodendron rautanenii*, *Maba mualala*, *Dialium simii*, *Ochna pulchra*, *Terminalia sericea*, *Combretum spp.*, *Burkea africana*; in the northern portions *Afzelia cuanzensis*, *Kirkia acuminata*, *Diospyros spp.*, *Acacia giraffæ*, *Amblygonocarpus obtusangulus*. In the vleis scattered through the areas are large trees of *Diospyros mespiliformis* and *Combretum petersii*; these, however, usually occur on termite mounds.

Type 4. Mfuti (*Brachystegia woodiana*). The mfuti or umtjabele type occupies a warmer and drier zone than the msasa. The type is widespread on the middle veld. It borders the low veld on both sides of the main plateau. The mfuti is perhaps the most widely distributed of the *Brachystegias*, and has a fairly wide altitudinal range. The tree is intolerant, vigorous, coppices freely, is extremely hardy, and in dry situations remains leafless until sufficient rain has fallen to supply water to flush it into leaf. Its associates are trees that occupy dry situations. In the north-west parts of the Colony, on shallow soils, particularly between Wankie and Matetsi, the mfuti is replaced by *Kirkia acuminata*. Trees frequently associated with the type are:—

Diospyros mespiliformis (on termite mounds notably in the Hartley district), *Afzelia cuanzensis*, *Afrormosia angolensis*, *Peltophorum africanum*, *Kirkia acuminata*, *Acacia nigrescens*, *Acacia spp.*, *Sclerocarya caffra*, *Dichrostachys nutans*, *Pterocarpus spp.*, *Copaifera mopani*, *Terminalia robusta*, *Terminalia sericea*. The tree, as with other *Brachystegias*, avoids ill-drained areas which are either covered with grass or occupied by *Copaifera mopani*. In the north-eastern parts of the Colony the muturu (*Brachystegia utilis*) is a common associate near the boundary of the mopani veld. Margins of vleis in the *Brachystegia woodiana* zone are occupied by *Combretum spp.*, *Terminalia spp.*, *Securidaca longipedunculata*, *Lonchocarpus capassa*, *Kigelia pinnata*, *Acacia campylacantha*, *Acacia spp.*, etc.

Type 5. Mopani (*Copaifera mopane*). Mopani occurs in nearly pure forest over extensive areas. Unlike the *Brachystegias*, the mopani is capable of living in low-lying land alternately very wet or very dry. In the low veld it occupies places which in similar situations on the high veld carry grass. Frequently mopani forests have very thin, poorly developed grass, or there may be large areas quite bare of grass with aloes only as an understory. In the south-eastern low veld, which enjoys a higher rainfall, the mopani extends northward only to the foothills and westward up the Limpopo valley (where conditions become drier) to the watershed at Plumtree, where it is found associated with *Proteas*.

In the low veld of the Zambesi Valley mopani also covers extensive areas, but on the drier western slopes of the main divide it is frequently found on the high veld almost to the main watershed. The tree occurs on the Bulawayo commonage, and patches occur in the Matopo Park.

Mopani is an aggressive tree, and tends to oust competitors. Its associates are chiefly found in the better drained areas. In typical low veld a characteristic associate is the Baobab (*Adansonia digitata*). On the higher parts of the eastern low veld it mixes with mfuti and mnondo. Other trees commonly found in the low veld are:—*Kirkia acuminata*, *Sterculia spp.*, *Afzelia cuanzensis*, *Sclerocarya caffra*, *Combretum petersii*, *Terminalia prunoides*, *Acacia nigrescens* or *pallens*, *Acacia spirocarpoides*, *Pterocarpus sericeus*, *Pterocarpus spp.*, *Berlinia globiflora*, *Commiphora*

spp., *Spirostachys africana* (Limpopo and Lundi valleys), *Euphorbia spp.*, *Diospyros mespiliformis* (along water courses and on termite mounds), *Bauhinia articulata*, *Combretum spp.*, *Kigelia pinnata*, *Lonchocarpus capassa*, etc.

In the eastern parts of the Sabi and Lundi valleys the hills and ridges which intersect the low veld are covered with *Androstachys johnsoni* mixed with an unnamed species of *Brachystegia*.

In the Zambesi valley a zone more or less parallel to the river is occupied by a long belt of *Copaifera gorskiana*. This belt extends from the neighbourhood of Wankie for at least 100 miles in a north-easterly direction.

The following is a list of the common or nativé names of the more important trees or shrubs mentioned in this article: —

Acacia giraffæ.—Camelthorn, Umohlo, Muhoto.
A. karroo.—Usinga.
A. nigrescens.—Knobthorn, Umkai.
Adansonia digitata.—Baobab, Mubuyu.
Afrormosia angolensis.—Ironwood, Muwanga.
Afzelia cuanzensis.—Pod Mahogany, Umkamba, Mwande.
Albizzia spp.—Mugaranyeze, etc.
Amblygonocarpus obtusangulus.—Mubaimbai.

Baikiaea plurijuga.—Rhodesian "Teak," Umgusu, Mukusi.
Berlinia globiflora.—Mutondo, Mnondo, Mwanza.
Brachystegia randii.—Igondi, Msasa.
B. tamarindoides.—Mountain acacia, Umbola, Muunzi.
B. utilis.—Muturu.
B. woodiana.—Umtjabele, Mfuti, Mubcmbo.
Bolusanthus speciosus.—Rhodesian Tree Wistaria, Umpaca.

Combretum petersii.—Hardekol, Umtjwili, Muzwiri.
Commiphora spp.—Kanidot, Minyela.
Copaifera coleosperma.—Rhodesian Mahogany, Umtjibi, Muzaoli.
C. mopane.—Mopani, Ipani, Musaro.
Cussonia spp.—Mufenji, Mushenje.

Dialium simii.—Muhamane.

Euclea lanceolata.—Umtjekisane.

Faurea saligna.—Beukenhout, Musasati, Musesetu.
F. speciosa.—Nyangandza.

Gleditschia africana.—Umsenye, Mubako.
Gymnosporia buxifolia.—Zihlangu, Mutotova.
Kirkia acuminata.—Umvumela, Muvumira, Muzumina.
Monotes glaber.—Mushawa, Muwara.
Ochna pulchra.—Umnyelenyele.
Parinarium mobola.—Grysappel, Umkunu, Muhatja, Mujakata.
Peltophorum africanum.—"Rhodesian Wattle," Umsehla, Muzeze.
Protea abyssinica.—Isiqalaba, Mubonda, Sundhla, Chindendere.
Pterocarpus angolensis.—Bloodwood, Umvagazi, Mukwa, Mubvamaropa.
Ricinodendron rautanenii.—Ngoma, Mugongo.
Rhus lancea.—Ugcane.
Sclerocarya caffra.—Marula, Umganu, Mulula.
Securidaca longipedunculata.—Rhodesian Violet Tree, Umfufu, Mwinda.
Swartzia madagascariensis.—Mushakashela.
Terminalia sericea.—Yellow-wood, Mangwe, Mukonono, Muhonono.
T. robusta.—Umsusu.
Uapaca kirkiana.—Mahobohobo, Muzhanzhi.

Tobacco Experiment Station, Salisbury.

REPORT OF GENERAL CROP EXPERIMENTS.

By C. A. Kelsey Harvey, Manager.

(Published with the Authority of Chief, Divisiôn of Plant Industry.)

Underplanting Maize with Legumes.—These trials have been carried out to ascertain the possibility of maintaining soil fertility by yearly planting a leguminous crop between the rows of maize, and later ploughing under that crop when the maize has been stooked. Doubt existed as to the best date to sow the underplanted crop, and a number of plots were included in the experiment to be underplanted at different periods of the growth of the maize. The work has been in progress for three years, each year the maize being check-rowed 3 x 3 feet apart with two plants left to each "hill," and the maize receiving annually 150 lbs. of bone and superphosphate per acre. The fertiliser has been placed in the hill three weeks to a month before planting. Kaffir beans (cowpeas) were used as the legume, different plots being underplanted when the maize was (a) 4 to 6 inches high, (b) after the first cultivation of the maize, (c) after the second cultivation of the maize, (d) after the third or last cultivation of the maize.

In the case of (a), (b) and (c) it was necessary to plant the kaffir bean seed by hand between the maize plants in order not to impede subsequent cultivation. In the case of (d), (i.e., after the last cultivation) the seed was broadcasted under the maize, the cultivators coming behind covered it in. Over the three years during which this experiment has been

carried out, a better growth of kaffir beans has invariably been obtained by the last method. Furthermore, broadcasting the underplanted crop between the rows is more speedy and economical than planting by hand between the maize plants. Each year it has been the custom to cut the tops of the maize crop for ensilage, which has enabled more light to get to the underplanted crop in the later stages of its growth. The maize is stooked as soon as sufficiently advanced and the underplanted beans are ploughed under with the utmost expediency.

It has been found in the case of beans planted when the maize was 4 to 6 inches high that little or no green growth was available to plough under, since the plants had dried off and set seed before the maize was ready for stooking. The beans planted after the first and second cultivations of the maize made a poor growth, leaving very little material to be ploughed under. On the other hand those sown just prior to the last cultivation have each year made excellent growth.

The results over the three-year period have been as shown below:—

UNDERPLANTING MAIZE WITH COWPEAS.

Soil.—Grey sand. The land carried two successive fertilised tobacco crops in 1926-27 and 1927-28. Maize variety: Salisbury White. Rainfall: 1928-29, 27.32 inches; 1929-30, 21.45 inches; 1930-31, 28.67 inches.

Maize Yields in Bags per Acre.

Kaffir beans underplanted.	1928-29.	1929 30.	1930-31.	Average yield 3 years.
When maize was 4—6 inches high	15.23	11.55	8.56	11.78
After 1st cultivation of maize ...	17.47	13.51	6.18	12.38
After 2nd cultivation of maize ...	17.97	9.57	7.28	11.6
After last cultivation of maize ...	20.99	14.40	9.64	15.01
Control No. 1. No underplanted crop	17.36	13.05	7.79	12.73
Control No. 2. No underplanted crop	15.87	11.74	7.53	11.71

Results over the three years show that to obtain the best volume of green matter for ploughing under, the kaffir beans should be broadcasted between the rows of maize at the last cultivation of the crop, namely, somewhere about the middle of January. A glance at the table of averages will show that where this has been done an increased yield of maize has been maintained over the control plots where no green manure was ploughed in, and also over the other plots where the underplanting was a failure or partial failure.

In broadcasting the kaffir beans between the maize rows, about 40 lbs. of seed was used per acre; where the beans were planted in the row between the maize plants, about half this amount of seed was employed.

Green Manuring Trials.—This experiment was designed to compare the growth and yield of maize following a legume and non-legume sown together, with maize following a mixture of two legumes ploughed under. The green manure crops were (a) sunflower mixed with Sunn hemp, and (b) velvet beans mixed with kaffir beans.

The trial was carried out on some of the poorest sandy soil on the station. Two plots were planted to their respective green manures on the 6th December, 1928, and the crops were ploughed under at the end of January, 1929; a third plot was kept under bare fallow as a control. The sunflower and Sunn hemp seed were mixed and broadcasted at the rate of 60 lbs. to the acre, and the two crops made an even growth. The kaffir beans and velvet beans were planted in alternate rows, each row being 3 feet apart, with seeds dropped 18 inches in the row. The kaffir beans over-grew the velvet beans to some extent. Fertiliser was applied at the beginning of November, 1929, being placed in each hill after the land had been laid off in check rows. The subsequent maize crop was planted on the 25th November, the spacing being 3 feet apart each way, four seeds to a hill, the plants being later thinned down to two per hill. The same plots were again planted to maize in the season 1930-31. Results over the two seasons were as follows:—

Maize Variety: Salisbury White.—All plots were fertilised each year with 150 lbs. bone and superphosphates per acre. Rainfall: 1929-30, 21.45 inches; and 1930-31, 28.67 inches.

Green Manure Crop.	Yield in bags per acre, 1929-30 Season.	Yield in bags per acre, 1930-31 Season.	Average yield of the two Seasons.
Sunn hemp and sunflower mixed	10.24	5.96	8.10
Kaffir beans and velvet beans ...	11.54	6.42	8.98
Control: No green manure ...	4.28	5.40	4.84

The soil of these plots closely approached a drift sand and was such as would not normally be cultivated on most farms. It will be noted that the beneficial effect of green manuring was very evident in the first season, but had practically disappeared by the time the second maize crop was grown. A small advantage is indicated in favour of the two legumes as against the legume and non-legume.

In a similar experiment on adjoining plots tobacco was grown after the green manures in place of maize. Hickory Pryor was the variety, and the crop received each year a fertiliser dressing of 200 lbs. of double complete tobacco fertiliser per acre. The average yields obtained according to grade over the two years were as follows:—

Green Manure Crop.	Average yield per acre over 2 years in lbs.	Percentage of Grades.				
		Brights per cent.	Medium Brights per cent.	Mediums per cent.	Darks per cent.	Greens per cent.
Sunflower and Sunn hemp	277	0	24.3	50.6	9.8	15.3
Kaffir beans and velvet beans	554½	5.95	16.45	35.8	19.35	22.45
After summer fallow (control)	381	3.25	8.7	53.7	20.15	14.2

The results again indicate the superiority of two legumes over a legume and a non-legume on this type of poor soil. It will be noted, too, that not only is an increased yield of tobacco obtained after the two legumes, but that the quality of the leaf is at the same time well maintained.

Tobacco following Velvet Beans ploughed under in a Rotation.—**The field concerned has been under cultivation**

for five years, the soil being of the usual light sandy type common to the station. The rotation was as follows: 1925-26, tobacco with 200 lbs. double complete fertiliser (N7, P_2O_5 20, K_2O 10); 1926-27, tobacco with 150 lbs. blood meal fertiliser (N6, P_2O_5 18, K_2O 8); 1927-28, ground nuts without fertiliser; 1928-29, velvet beans ploughed under.

In the fifth year, namely, 1929-30, twelve plots were put under tobacco, fertilised with 200 lbs. per acre of a double complete fertiliser (7-20-10) applied before planting. An extra 50 lbs. per acre of the same fertiliser was applied as a top dressing four weeks after planting. The tobacco was Hickory Pryor. The land was ridged and the plants spaced 3 feet apart each way. The crop was planted with favourable rains on the 23rd November, 1929, and reaping commenced on the 2nd March, 1930.

The tobacco following velvet beans ploughed under gave excellent yields and found a ready market with a local exporting buyer at an average price of 11d. per lb.

Soil: Light sandy soil (granite formation). Rainfall: 21.45 inches.

Average Yield of Twelve Plots: 1929-30 *Season.*

	Average Percentage of Grades.				
Average yield per acre.	Brights.	Medium Brights.	Mediums.	Darks.	Greens.
1,187 lbs.	3%	10%	53%	28%	6%

In the season 1930-31, Hickory Pryor tobacco was again grown on the same plots. The season was not so favourable for tobacco as the previous one, and a number of plots were infected with angular leaf spot.

The following table shows the average yield and percentage of grades over the same twelve plots in the second year following the green manuring.

Rainfall: 28.67 inches. Fertilised: 200 lbs. double complete per acre.

		Percentage of Grades.					
Planted.	Average yield in lbs. per acre.	Brights.	Medium Brights.	Mediums.	Darks.	Greens.	Perished.
24.11.30	662.5	11%	14%	38%	10%	13%	14%

Note.—Owing to the infection of certain plots with angular spot, 14 per cent. of perished leaf is shown in the grade analysis.

The average yield of the two tobacco crops was 924.7 lbs. per acre, with the following percentage analysis of grades:—

Brights, 7.0 per cent.; Medium Brights, 12.0 per cent.; Mediums, 45.5 per cent.; Darks, 19.0 per cent.; Green, 9.5 per cent.; perished, 7.0 per cent.

The first series of this rotation indicate that it should be possible to grow four payable tobacco crops in six years on the same soil if the land is rotated and the tobacco crops are preceded by a suitable green manure crop.

Reference to the tables will show that the predominant grades of tobacco are mediums. This, however, appears a factor in favour of the rotation, since at the present time there seems to be an expanding market for this type of leaf.

Maize and Tobacco after Various Green Manure Crops.—The object of this experiment was to ascertain the relative merits of various green manure crops for maize and tobacco on the sand veld. The results given apply only to one year, but serve as an indication for further work on these lines. The land utilised had carried two tobacco crops and one maize-silage crop before the green manures were sown. In 1930-31 maize and tobacco were planted following velvet beans, dolichos beans, Sunn hemp and kaffir beans ploughed under in 1929-30.

The maize was check-rowed 3 feet by 3 feet apart on the 26th November, 1930, and received 150 lbs. of bone and superphosphate per acre. The tobacco was similarly planted on the 24th November, and received 200 lbs. double complete tobacco fertiliser per acre. Adjacent plots were planted to maize and tobacco, following a maize crop the previous year, to act as controls.

The following table gives the first year's results:—

Maize after Green Manures.

Previous Green Manure Crop.	Average plot yield per acre, in bags.
Dolichos beans	7.12
Sunn hemp	7.33
Velvet beans	12.27
Kaffir beans	6.67
None (control)	3.75

Tobacco after Green Manures.

Previous Green Manure Crop.	Yield in lbs. per acre.	Aanlysis of Grades.					
		Brights. per cent.	Medium Brights. per cent.	Mediums. per cent.	Darks. per cent.	Greens. per cent.	Badly Perished. per cent.
Dolichos beans ...	506	13	15	35	7	11	19
Sunn hemp	560	10	13	43	7	10	17
Velvet beans	569	12	11	39	4	8	26
Kaffir beans	832	10	11	46	13	7	13
None (control) ...	456	7	9	51	6	10	17

On the first year's results it would seem from the above tables that the greatest yield of maize is from the plot where velvet beans were used as the green manure, and the greatest yield of tobacco from where kaffir beans were ploughed under. In both cases comparison with the control plots demonstrates the value of green manuring.

Green Manuring on Contact Soil: The Whole Crop ploughed under versus *the Seed reaped and the Residue of Crop ploughed under.*—In this experiment the plots were situated on strong contact soil, one-half of each set of plots having the whole green manure crop ploughed under, and the other half having the seed reaped and only the stubble or residue ploughed under. The various green manure crops, namely, Sunn hemp, velvet beans, dolichos beans and kaffir beans, were sown in the 1929-30 season, the "whole crops" being ploughed in at the end of February, 1930, and the reaped plots being ploughed in April of that year. The average yield of seed from the reaped plots was: velvet beans, 220 lbs. per acre; dolichos beans, 660 lbs. per acre; kaffir beans, 216 lbs. per acre; Sunn hemp, 450 lbs. per acre.

The trials were primarily laid down to ascertain whether a complete green manuring on strong contact soils would cause the following tobacco crop to be too heavy and difficult to cure, but the experiment was duplicated to observe the effect of the same treatment on a maize crop on this type of soil. The following table gives the first season's results:—

Variety: Salisbury White (24 plots), check-rowed 1st December, 1930; 3 feet by 3 feet. Fertiliser applied: 150 lbs. bone and superphosphate per acre.

Maize Yields in Bags per Acre.

Green Manure.		Average of plots per acre.
Sunn hemp	Whole crop ploughed under	12.28
Sunn hemp	Reaped for seed and residue ploughed under	8.45
Dolichos beans ...	Whole crop ploughed under	11.23
Dolichos beans ...	Reaped for seed and residue ploughed under	11.12
Velvet beans ...	Whole crop ploughed under	10.11
Velvet beans ...	Reaped for seed and residue ploughed under	10.97
Kaffir beans	Whole crop ploughed under	9.53
Kaffir beans	Reaped for seed and residue ploughed under	10.58

Tobacco Yields in lbs. per Acre.

Green Manure.		Average yield of plots per. acre.
Sunn hemp	Whole crop ploughed under	910
Sunn hemp	Reaped for seed and residue ploughed under	841.5
Dolichos beans ..	Whole crop ploughed under	970
Dolichos beans ...	Reaped for seed and residue ploughed under	758
Velvet beans ...	Whole crop ploughed under	1,032.5
Velvet beans ...	Reaped for seed and residue ploughed under	907.5
Kaffir beans	Whole crop ploughed under	803
Kaffir beans	Reaped for seed and residue ploughed under	787.5

The tobacco varieties grown were Hickory Pryor, Willow Leaf, White Stem Orinoco and Jamaica Wrapper, there being six plots of each variety. The crop was planted on the 2nd December, 1930, and received 200 lbs. per acre of double complete tobacco fertiliser.

On referring to the average plot yields, it will be observed that on the maize plots, except in the case of Sunn hemp, there was little or no increase in yield in favour of the complete green manuring, but if the returns of all the plots under each treatment are considered, an increase of 0.53 bags per acre in favour of this treatment is revealed.

With the tobacco plots, on the contrary, in every case an increased yield of leaf is recorded where the whole green crop was ploughed under. Averages over all the plots indicate an increase of 105½ lbs. per acre in favour of ploughing under the whole crop. A point of interest is the fact that the plots having the residue only ploughed under ripened a week to ten days earlier than the plots having the whole crop ploughed under.

The following table gives the average percentage of grades from the tobacco plots:—

	Brights.	Medium Brights.	Mediums.	Darks.	Greens.	Badly Perished.
	%	%	%	%	%	%
Sunn hemp ploughed under	5	9	50	8	4	24
Sunn hemp reaped and residue ploughed under	12	13	50	8	9	8
Dolichos beans ploughed under	5	11	51	10	2	21
Dolichos beans reaped and residue ploughed under	6	12	48	17	7	16
Velvet beans ploughed under	6	13	45	8	7	21
Velvet beans reaped and residue ploughed under	9	11	53	9	5	13
Kaffir beans ploughed under	10	7	42	13	4	24
Kaffir beans reaped and residue ploughed under	6	15	40	12	3	24

It will be observed that a higher percentage of the bright and medium bright grades was obtained where the legumes were reaped only and the residue ploughed under. The percentage of "medium" tobacco remained approximately the same in all cases, but a slight increase of dark tobacco resulted from ploughing under the whole green crop. A significant fact, however, is to be noted in the badly perished grades, there being 9 per cent. more badly perished leaf from the plots where the whole of the green manure was ploughed

under, due mostly to disease, particularly red rust, in the late part of the season. The results indicate the undesirability of following tobacco directly after a green manuring on this type of land.

It should be noted that the experiments were carried out on *strong, red contact* soil as distinct from the light grey sand, on which the benefits of ploughing under the whole green crop have already been commented on.

The lack of response by the maize to green manuring on contact soil is difficult to explain, and the results conflict entirely with those obtained on the heavier red clay loam of the Salisbury Agricultural Experiment Station.

(To be concluded.)

The Potato

(Solanum tuberosum.)

(Concluded.)

METHODS OF CULTIVATION IN SOUTHERN RHODESIA.

By S. D. TIMSON, M.C., Dip.Agric. (Wye),
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Cultivation.—Where planting is done some time before the arrival of the rains in spring, the ridges should be pulled down and levelled again. This facilitates the killing of weeds and the maintenance of a loose mulch by means of drag or chain harrows before the plants appear above ground. This is the cheapest and best method of killing weeds, and can be continued until after the first leaves of the plants are above ground. If the lands are quite free from trash, as they should be, and if the soil is not too wet and sticky, these types of harrow and also, particularly, the walking weeders, will not injure the young plants and will greatly economise labour.

As soon as the lines of the potatoes can be easily seen, cultivation should be carried on between the rows as often as is necessary completely to control weeds and keep the soil loose and friable. The potato crop cannot withstand competition from weeds, and it must be kept free from them. At first, cultivation should be deep and close to the plants, as their roots are still short and not easily damaged, but later cultivations must be quite shallow, and great care must be taken to avoid injury to the root system and the breaking off of young tubers, which commence to form before the crop begins to flower.

After the crop is about 12 to 15 inches high, it should be ridged up with a light ridging plough. From this time onwards it should need little attention beyond a further ridging by hand hoe or plough, when great care should be taken that soil is placed round the stems of the plants, and that any cracks appearing in the soil are filled up so as to prevent the entry of tuber moth, and to protect the tubers from exposure to light, which causes them to turn green.

Under Irrigation.—Cultivation of the soil after planting the crop under irrigation must necessarily be done by hand, since the ridges cannot be broken down. Continued cultivation must be done to keep the surface of the soil from "crusting" and cracking and to kill all weeds. On the heavier soils, particular care must be taken that cultivation is not done too soon after irrigation, owing to the danger of packing the soil, and thus causing malformed tubers and making the subsequent lifting of the crop difficult.

Irrigation of the Crop.—During the early growth of the crop it should not be heavily irrigated, as this discourages the development of the root system both in regard to depth and extent.

Sufficient water should be led on at the first irrigation immediately after planting to bring the potatoes above ground. In some particularly porous soils, with abnormal sub-soil drainage, this is not possible, and further irrigation may be necessary, but the water-holding capacity of such soils can be improved year by year by building up the humus supply by means of applications of kraal manure or by green manuring during the summer.

After the crop is well established and growing strongly, the soil should be maintained in a moist condition, as the presence of ample moisture, without excess, is essential if the potato plant is to obtain its food supply easily, and keep up the continuous rapid growth which is so necessary with the winter-grown crop in order to catch the early market.

The need of potatoes for a uniform distribution of water is shown by the results of a five years' experiment carried out in Utah, where it was shown that one inch of water

weekly, or a total of 12.8 inches during the season; gave a higher yield than any other treatment.*

The soil should never be allowed to dry out, as, with extremes of drought and moist conditions alternating, irregular growth and malformation of the tubers will result. Furthermore, if the soil is allowed to dry out and crack open, this will allow the easy ingress of the tuber moth, the worst pest of the potato crop. The period when the crop makes its biggest demands on the water supply is from just before flowering until maturity, as it is then that the tubers are growing, and during this time an ample supply of water must be maintained.

Mr. G. Syfret, an experienced grower of potatoes under irrigation, in an article published in the *Rhodesia Agricultural Journal*, states "constant watering, I have found, helps to prevent frosting. This may be an empty theory of mine. I do not contend that in this way lands which have no protection from frost are thereby made frost-proof, but where only mild frosts are felt it certainly does help." Whether this is so or not, the writer is unable to say, but it would appear to be a point worthy of consideration by other growers.

Economy of Irrigation Water.—Many growers are faced with a possible shortage of water for irrigation towards the end of the winter, and must economise their supply in every possible way. This can be assisted in many cases by increasing the humus supply in the soil by green manuring the land in summer and by the application of heavy dressings of farmyard manure, where this is feasible.

Deep and thorough preparation of the soil, down to a depth of ten inches or more where local conditions allow, and the use of Martin and similar cultivators for breaking up the subsoil, will help in the economy of water, because this extends the feeding range of the crop's root system, and encourages its development, and also because the increased aeration of the soil renders available more of the reserve plant food in the soil.

Heavy dressings of the necessary fertilisers will also assist to economise water, as the transpiration ratio of a crop

* "Agricultural Meteorology," by S. Warren Smith.

varies inversely with the fertility of the soil. In an infertile soil the crop must take in much larger quantities of water, carrying plant food in solution, to obtain its food requirements, than in a fertile soil. Constant attention to the maintenance of a loose mulch on the surface of the soil, by decreasing evaporation, and killing weeds, is also of assistance.

Harvesting.—The main crop is not harvested as a rule until the haulms have completely died off and may be safely left in the ground through the winter until early spring, but the greatest care should be taken to see that all cracks in the soil are filled in so as to prevent the entry of the tuber moth. As soon as the haulms are dead they should be pulled off, and the holes left in the tops of the ridges by their removal should be carefully filled in with soil. The entry of light through cracks in the soil also causes the tubers to become green in colour. Winter crops are not as a rule left in the ground to mature thoroughly, but are lifted as early as possible to catch the early market. Irrigated potatoes, obviously, cannot be left in the ground to keep for any length of time and must be lifted before the first rains in spring. They do not keep quite so well as main crop potatoes, and need greater care in handling during lifting as they are more easily bruised.

The crop may be lifted by hand by means of the 4-prong vine hoe, or by means of a ridging plough. On the heavier soils in this Colony, the special types of potato-digging machinery have not given good results, but some of the types of ridging ploughs fitted with two sets of shaking prongs behind the plough are being used with success. The shaker prongs are removable and the implement can then be used as an ordinary ridging plough. One grower who used this type of lifting plough reports that he has lifted two acres of a heavy crop of potatoes in two hours, the implement being pulled by a medium-powered tractor in top gear. Six oxen are sufficient to pull it, but do not do such good work as the tractor, owing to the slower pace at which they travel. The soil on which the above result was obtained is a medium red loam.

As soon as the potatoes have been lifted, they must be placed under shade to protect them from sun scald, and they should be spread out to dry off before bagging.

Pests of the Crop.—The principal pests of the potato crop in this Colony are cutworms, tuber moth and eelworms (*Heterodera radicicola*). Cutworms may be destroyed by poison baiting before planting, as described in the *Rhodesia Agricultural Journal* of November, 1928, page (Bulletin No. 714), but after the plants are up, hand-picking the caterpillars from the soil around the stems of the plants appears to be the only practicable measure.

Methods of control of eelworms were discussed in an article which appeared in the *Rhodesia Agricultural Journal* of September, 1927, page 957, and reprinted as Bulletin No. 654. They do not as a rule cause serious trouble to early planted winter-grown crops, but may cause great loss to summer crops, and in fact may make it impossible to grow a profitable crop of potatoes. They are particularly troublesome on irrigated land, and may make such land useless for the production of potatoes or any other susceptible crop.

Where eelworms are known to be present in the soil, the only green manure crop at present commonly grown in this Colony which can be recommended for preceding a potato crop, or to be included in a rotation with potatoes, is Sunn hemp. This crop is comparatively immune from eelworm attack, and for this reason, in addition to others mentioned in the paragraph on green manuring, it is advisable always to use Sunn hemp as a green manure for potatoes, since a farmer may not know until the damage is done that his soil is becoming infested with the pest, and the use of a susceptible crop such as dolichos beans may enormously increase a slight infestation.

Farmers are particularly warned against the use of dolichos beans for green manuring potato land infested with eelworms, since several growers have had a disastrous experience with it recently, and their potato crops have been ruined by the pest. Other susceptible green manure crops are sunflowers, white stingless velvet beans and kaffir beans.

The tuber moth probably causes more damage to the potato crop than any other pest in this Colony. The eggs are laid on the tuber and the full-grown caterpillar makes its way to the surface of the soil. The adult moths may infest other tubers of the growing crop by entry into the

soil through cracks. It is therefore of the greatest importance that all cracks in the soil should be closed by constant cultivation, and as soon as the crop matures and the haulms die off, the latter should be pulled off and the holes left in the soil by their removal should be filled in by drag-harrows or by hand hoes. "Seed" tubers are always liable to become infested, and it is one of the advantages of early planting of the crop in dry soil before the arrival of the rains, that the burying of the tubers in the soil protects them from infestation by this pest. "Seed" tubers may be treated with carbon bi-sulphide fumes to kill the larvæ of the moth before planting, in the same way as is described elsewhere for the acceleration of sprouting of "seed" tubers, but the effect of this treatment is incomplete.

Diseases.—It is not proposed to discuss the question of the diseases of the potato, since the subject is dealt with by the Plant Pathologist in an article published in the August issue of this Journal, but the writer would like to take this opportunity of emphasising the advantages to be reaped in the increased yields of potatoes obtained by spraying or dusting the growing crop to control the "early blight" disease. Growers in this Colony are very backward in this matter, and are urged to give the matter their immediate attention.

Yields and Marketing.—The average yield per acre throughout the Colony is very low, as is shown by the table below, which gives the total acreage under the crop each year for the past five years and the yield per acre in bags of 153 lbs. gross weight.

Year	Acreage	Summer Yield	Yield per acre	Acreage	Winter yield	Yield per acre	Total summer and winter	
							Acreage	Yield
1925-26 ...	1,510	30,734	20.3	739	16,130	21.8	2,249	46,864
1926-27 ...	1,412	27,578	19.5	1,771	23,950	13.5	3,183	54,483
1927-28 ...	1,829	41,791	22.8	978	14,943	15.3	2,807	56,734
1928-29 ...	1,588	31,727	20.0	896	18,830	21.0	2,484	50,557
1929-30 ...	1,666	43,534	26.0	891	17,825	20.0	2,557	61,359

The reason for these low average yields is undoubtedly due to the crop being grown largely under unsuitable conditions, or because it has not received the proper treatment. That yields from the main crop of 100 to 120 bags (of 150 lbs. each) per acre are obtainable over considerable acreages when the crop receives proper treatment is being amply demonstrated by the principal growers each year, and yields of 200 bags per acre are being obtained by one grower of irrigated winter potatoes. Naturally the yields per acre vary in accordance with the rate of application of manures and fertilisers, but it may be said that on average red soil, with a dressing of 10 to 12 tons of kraal manure and 400 lbs. per acre of a complete fertiliser having a 20-4-10 analysis, yields of 80 to 120 bags of potatoes per acre should be obtained in the summer season if the crop receives proper cultural treatment.

Before marketing the crop, it should be carefully graded according to size, and any potatoes showing the least blemish should be discarded. The question of proper grading is of the utmost importance, and the greatest care should be given to the handling of the crop when lifting it and when grading and handling prior to marketing, to avoid any blemishes on the tubers, which will reduce the price obtained very considerably.

The best prices are obtained for the early crop grown in the winter, which comes on the market after the main crop has been exhausted. As a general rule the first of the "early" crop is not on the market before the middle of September, though a few which have been planted with the last summer rains and finished under irrigation may be on offer before this date.

Everything that can be done throughout the growing and handling of the winter crop to bring it on the market earlier should be done, as the prices obtained for the first of the early crop are so much higher as a rule than those for the main crop or the later supplies of the early crop.

In the table below are given the figures of the imports and exports of potatoes for Southern Rhodesia during the five-year period from 1926 to 1930:—

Year	Imports. Bags of 153 lbs. gross	Value £. (s. d. per bag in brackets)	Exports. Bags of 153 lbs. gross	Value £. (s. d. per bag in brackets)
		(21/5)		(21/1)
1925-26	13,497	13,739	10,024	10,570
		(15/1)		(21/9)
1926-27	24,282	18,357	11,460	12,473
		(14/-)		(16/6)
1927-28	29,658	20,811	12,259	10,137
		(13/4)		(18/6)
1928-29	35,867	23,873	13,885	12,849
		(8/9)		(13/10)
1929-30	27,943	12,215	16,828	11,690

As will be seen, from £12,000 to £24,000 per annum has been expended during that period in payment for potatoes imported into this Colony from the south which should have been grown locally. It would appear that there is a need for co-operative effort among potato growers to obtain an orderly and efficient marketing of the crop, thus ensuring regular supplies. It is during the periods of temporary shortage and consequent high prices that most of these potatoes are imported, and better organisation amongst the growers would avoid these shortages. There is no reason why the whole of the needs of this Colony for potatoes should not be grown within its own borders.

SUMMARY.

1. Cull potatoes are a valuable feed for all adult stock, but contain too little protein for young growing stock or laying hens.

2. The potato prefers a deep, free-working, cool and fertile loam, but can be grown on any soil not infertile, if well drained and if humus and fertiliser are supplied.

3. The potato is a delicate feeder with a delicate root system; therefore a thoroughly and deeply prepared seed-bed is essential to success. For the same reasons and because its growing season is so short in this Colony, it must have an ample food supply in an easily available form.

4. Organic matter in the soil in ample quantities is essential to success, and it may be supplied in the form of farmyard manure and green manure.

5. Maintain tilth on irrigated land by green manuring in the summer with Sunn hemp sown broadcast at the rate of 40 lbs. per acre. Plough under the green manure sufficiently early to allow it to rot thoroughly before planting potatoes.

6. Phosphate is chiefly needed by the potato crop; but potash and some quickly available nitrogen are also necessary. Use superphosphate, sulphate of potash and ammonium sulphate. Wood ashes and sunflower ashes can be used as a source of potash. Applications of 300 to 500 lbs.—or even more—of superphosphate (20 per cent.), 80 to 120 lbs. of sulphate of potash, and 50 to 100 lbs. of sulphate of ammonia are suitable, in addition to farmyard manure at the rate of 12 to 20 tons per acre.

7. Farm or kraal manure must be thoroughly rotted. Apply heavy dressings before ploughing, and lighter dressings in the furrows. Fertilisers may be applied in the furrow at planting, but should not come in direct contact with seed. Only readily available forms of fertiliser should be used, but success cannot be expected with fertilisers alone. Plant in furrows 30 to 36 inches apart and 12 to 18 inches between plants in the rows, according to fertility of soil, rate of application of fertiliser and vigour of seed.

8. Keep furrows as near contours as possible on irrigated land.

9. If soil is heavy and liable to pack when moist, plant in dry soil in October-November, but then planting must be deep so that there is at least 5 inches of soil above the top of the seed.

10. Planting behind a 3-furrow plough is very unsatisfactory. Three methods of planting the irrigated crop are described. Plant main crop from October to December and irrigated crop from March to August if land is frost-free, but not before August if frost may be severe.

11. After planting the main crop before the rains, flatten the ridges and keep the land quite free of weeds by the use of light drag-harrows and chain-harrows. These and walking weeders can be used until the first few leaves of the plants are above ground.

12. Continue cultivation between the rows as soon as they are easily seen. Kill all weeds and keep surface soil loose and friable. Cultivate deeply at first, but later cultivations must be shallow and carefully done to avoid damage to young tubers and roots. Ridge up the rows when plants are about 12 to 15 inches high, and control weeds by hand hoeing. Fill all cracks in soil and holes around stems to prevent entry of tuber moth and light. Under irrigation, take care not to cultivate too soon after irrigation on heavy soils; any crust formed should be broken up at once by hand hoeing.

13. Do not irrigate too heavily during early growth; later, maintain soil in moist condition but not too wet. Never allow soil to dry out. The crop needs most water from before flowering until maturity. Economise irrigation water by maintaining an ample supply of humus in the soil; by deep and thorough preparation of the soil before planting, and by maintaining a loose mulch.

14. A supply of the best available seed is the most important item in potato growing. Use sprouted seed with short sturdy green sprouts and greened tubers. If seed cannot be kept in good condition until rains arrive in spring, it will keep best if planted out. Seed will keep well if stored in shallow layers, exposed to free circulation of air and subdued light.

15. Sprouting can be accelerated by treatment with carbon bi-sulphide vapour, and further accelerated by placing in a warm tobacco barn or room. Reject all seed showing any signs of disease or abnormality of sprouts.

16. With "first or second from imported" seed, which is more or less free from virus diseases, 2 oz. seed is sufficiently large, but with seed more remote from importation and infected with virus disease, large seed will probably pay best—up to 2½ ozs. and even larger.

17. The larger the seed the greater the total yield, but the higher the proportion of small tubers in the crop where seed is free from virus infection. If seed is free from virus infection, smaller seed will give a higher proportion of ware potatoes, but if infected, small seed reduces the total yield too much.

18. Small whole tubers give better results than halves of large tubers. If necessary to cut seed, cut in halves longitudinally through rose end, and plant only in moist soil. Never plant cut seed in dry soil unless irrigated at once.

19. From 1,200 to 2,700 lbs. seed per acre are required according to spacing and size of seed.

20. Harvest main crop after haulms are all dead. Remove dead haulms and fill in holes left in soil, and all cracks, to prevent entry of tuber moth. The crop can be safely left in the ground until July or August.

21. Control cutworms by poison-baiting and hand-picking. Prevent tuber moth infestation by planting main crop early and by preventing entry by holes and cracks in soil. Carbon bi-sulphide fumes will kill most of larvæ in seed potatoes.

22. Spray or dust your potatoes during critical period of growth to control early blight, and so extend the growing period and largely increase yield of crop.

23. Carefully grade your crop for market according to size. Remove all tubers having any blemish. This is essential to obtaining good prices.

24. Each year potatoes to the value of £12,000 to £20,000 are imported. These should be grown in Southern Rhodesia.

Some Impressions of Farming in Great Britain.

[*The following notes were written at our request by Mr. D'Urban Barry, who toured Great Britain this year with the party of South African farmers. Reference to the tour is made in our editorial columns.*—Ed.]

We had a most interesting tour, and saw the best parts of England from a farming point of view. I think the best agricultural land we saw was in the neighbourhood of Cambridge, Wisbech and Spalding, especially in the latter district. The soil there is of a rich deep loam and the crops we saw, mostly potatoes, were perfect in every respect, but then, they use just three times the amount of fertiliser that we do. Farming in England is so totally different from ours that it is almost impossible to bring the two methods together in any respect. There is more dairying done than in any other branch of farming; that and poultry farming seem to be the two most profitable lines. The Shorthorn "Dairy" still seems to be the most favoured dairy cow not pure bred. It is called "the Commercial Cow," and is more of the Shorthorn type than any other breed. Most of the milk is sold whole, and put up in carton boxes and then neatly packed in twelves in cardboard boxes and sent to the markets of the nearest towns, most of it to London. We were, of course, very much impressed with their spotlessly clean methods in every respect. The milking machine seems to be going out again; we saw mostly hand milking. Another thing that I was very much impressed with was the portable cowbyre, with accommodation for four cows at a time. There is an engine room and hurdle enclosure for about 50 cows. The whole outfit is on wheels and is pulled about by two horses from paddock to paddock, wherever needed. This contrivance seems to be taking on in England. A number of farmers are keeping their herds out in the paddocks all the year round, and find the cows are much healthier and doing better in every respect, apart from the

tremendous saving in labour, which is the most serious drawback to the English farmer to-day. They pay a tremendous wage and get very little done for it. I saw the English labourer loafing as much as our Mashona does.

Of course the grazing in England is the last word, I do envy their paddocks and wonder if we will ever be able to get our pastures up to the same standard. The Italian and Perennial ryegrass and Wild White clover seem to be the favourite pasture grasses. There is no question about England having the best pedigree stock in the world; if you want a good bull of any breed, there is only one place to get it from. I saw some wonderful cattle, and other animals as well, at the Royal Show. Unfortunately, due to foot and mouth disease, some of the best stock from parts of Scotland could not be sent. There were no cattle or stock of any kind at the Edinburgh Show, but wonderful horses. I was, however, fortunate in being able to see some of the best cattle in Scotland on their farms. These had been got ready for the Shows and were in the pink of condition—beautiful animals.

Sales.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

Spineless Cactus Slabs (Blades), Algerian Variety: 20 slabs, 5s.; 50 slabs, 10s.; 100 slabs, 17s. 6d.

Stocks are limited, and delivery cannot be undertaken after 15th November.

Kudzu Vine Crowns: 10 crowns, 5s.; 20 crowns, 7s. 6d.; 50 crowns, 15s.; 100 crowns, 25s.

Delivery during January for dry land. Owing to pressure of other operations, it is not possible to deliver Kudzu crowns during November and December. The prices are for delivery free at purchaser's nearest station or siding in Southern Rhodesia. Cheques should be made payable to the Department of Agriculture, and preliminary enquiries and subsequent orders should be addressed to the Chief, Division of Plant Industry, Department of Agriculture, Salisbury.

Subterranean Clover on the Sand Veld as Green Feed for Poultry in the Winter.

By S. D. TIMSON, M.C., Inter. B.Sc. (Agric.), London, Dip. Agric. (Wye), Assistant Agriculturist.

In the August issue of this Journal the great importance of an ample supply of green food to poultry was emphasised in a note issued by the Poultry Branch of this Department, and some of the many troubles brought on by lack of such food were enumerated.

During the summer there is, as a rule, little difficulty in obtaining supplies of suitable green food, but in the winter, many poultry keepers have great difficulty in doing so owing to lack of irrigation facilities.

The following notes on the use of subterranean clover for this purpose are written particularly to assist poultry growers on the sand veld who have on their farms a suitable moisture-retaining valley or vlei, which retains moisture throughout the winter months.

Lucerne is an ideal green food for poultry, but it cannot be grown successfully on vlei land, and few have a sufficient water supply to grow it under irrigation.

Subterranean clover has been found to be an admirable substitute for lucerne, and one large breeder has found that his poultry show a definite preference for Subterranean clover even when lucerne has been offered to them at the same time. This may be due to the fact that the foliage of the clover is more tender than that of lucerne.

Feeding Value.—The following analyses of Subterranean clover and lucerne hays, giving the percentage of crude nutrients in each, are taken from Bulletin No. 247, issued by the Department of Agriculture of Southern Australia.

	Moisture.	Ash.	Protein.	Fibre.	Fat.	Carbo-hydrates.
Lucerne	8.26	7.08	14.43	28.96	1.73	39.54
Subterranean clover ...	10.13	9.65	13.10	18.97	2.10	46.05

The starch equivalents are as follows:—

Lucerne	34.09
Subterranean clover	37.75

The nutritive ratios are:—

Lucerne	1: 3.7
Subterranean clover	1: 6.6

It will be seen that the feeding value of Subterranean clover hay compares very well on paper with that of lucerne, and this has been found to be the case in practical feeding tests in Australia. Although it contains somewhat less protein than lucerne, it contains considerably more carbohydrates and fat, and its starch equivalent is higher. It should be mentioned that the starch equivalent of Subterranean clover has been worked out on estimated figures for the digestible nutrients.

Local Experience.—Mr. Dunley-Owen, a poultry farmer near Salisbury, has found during the past winter that Subterranean clover is an admirable green feed for his birds, which have shown a distinct preference for it even when lucerne has been fed at the same time. He is very pleased with the results and intends to continue with it in future for winter feed. This gentleman sowed a tenth of an acre bed of the clover in February on a portion of typical wet, sandy vlei soil. The clover was sown in rows about eighteen inches apart and the land was given a fairly heavy dressing of dried poultry manure. The clover throve, and when at its best in mid-winter it was about 12 to 15 inches in height. Other farmers near Marandellas and in other granite areas have had similar excellent results with this clover on wet sandy vleis.

Recommended Methods of Establishment.—A section of vlei land, which does not become too swampy during the wet season, but is known to retain moisture throughout the winter, should be selected and should be ploughed and harrowed several times, commencing in winter or early spring. It should receive further harrowings from time to time to keep the weeds under control and to obtain a fine seed bed.

Rate of Seeding.—The clover should be sown about 12 to 18 inches apart at the rate of approximately 5 to 6 lbs. per acre. To give a rough idea of the thickness of sowing required, it may be said that about 12 to 18 seeds per foot length of row should be dropped. *It is very important that the seeding should be shallow*, and even on these light, sandy soils the maximum depth of seeding should not exceed half an inch.

Time of Sowing.—Subterranean clover can be sown at any time from November to February, but it is probable that sowings not later than January will prove best, since this gives the crop time to establish itself thoroughly before the arrival of winter. On land that becomes too wet to work in January, it may be sown in November or December. Those portions of the vlei should be avoided which remain completely covered with water during the wet season.

Manuring.—This clover exhibits an even greater need for a plentiful supply of phosphatic fertiliser than other legumes and responds well to applications of superphosphate. On the small scale on which the poultry keeper will need to plant it, heavy dressings of fertiliser can be applied at no great cost, and an application of 400 to 500 lbs. or even more per acre of superphosphate or rock phosphate is recommended. This will ensure rapid and strong growth. A dressing of about four to five bags per acre of dry poultry manure may also be applied and half to one ton of wood ash will also be useful as this tends to sweeten the soil if it is excessively acid and also supply any deficiency of potash there may be. Poultry manure has a very low content of phosphoric acid and a comparatively high content of nitrogen, and is therefore not a suitable fertiliser for clovers when applied alone. It is useful to help the clover establish itself quickly, but it should be liberally supplemented with phosphates.

The fertilisers and manure may be broadcasted and covered by the drag harrow just before sowing the seed.

Cultivation.—Although Subterranean clover competes well with weeds once it is established, it is best to keep the crop free from weeds by hand cultivation until the autumn, after which little trouble will be experienced in this way. The sowing of the crop in rows 12 to 18 inches apart will facilitate cultivation, and also make it easier to regulate the amount of clover to be cut each day.

Mr. Dunley-Owen, who sowed his Subterranean clover in early February, states "better results would no doubt be obtained if the clover were kept free from weeds until the autumn. I did not weed mine until the rains were over and it grew in grass three feet high."

Further experience is required before the area which it is necessary to plant to feed a given number of birds can be definitely stated, but from tests carried out on Dunowen farm, it would appear that half-an-acre of Subterranean clover of medium growth should supply sufficient green feed from April to October for 1,000 birds, if only one cut is taken during the period. At least two cuts should be obtainable in the seven months, and so the acreage per 1,000 birds can probably be reduced to a quarter of an acre. This is estimated on the basis of 5 lbs. of green feed per 100 birds per day.

This clover flowers and seeds at the end of August and September and finally dies off before the spring rains, and if it is desired to avoid sowing the crop afresh each year, cutting should cease in mid-July to allow the clover to flower and set seed. The seed pods are pushed under the soil, as is the case with ground nut, and the seed germinates early in the wet season. In the opinion of the writer, however, the poultry farmer will find it better practice to sow the crop afresh each year, as he will then be able to continue cutting until the plants die off.

The cost of the seed is not great, as it is obtainable locally at about 5s. per lb., and from the Union at about 3s. 6d. per lb. The cost of seed for a quarter-acre at the latter price will be 17s. 6d. to 21s., which is not a large annual expenditure per 1,000 birds.

It is desired, in conclusion, to emphasise that Subterranean clover is only recommended in this article for use on wet vlei land on the sand veld areas of the Colony where irrigation is not available to enable lucerne to be grown, and it is not intended to replace the latter where it can be grown successfully.

Other exotic clovers show equal promise of being useful for the same purpose, particularly Alsike clover and Giant Cowgrass or Perennial Red clover. Annual Red clover has not given such good results on Dunowen as Subterranean clover.

Milk and Maize for the Laying Hen.

A PRACTICAL PRODUCTION DEMONSTRATION.

[The following article by Mr. T. B. Cross, Lecturer in Poultry at Cedara School of Agriculture, has aroused a good deal of interest. It is therefore republished from "Farming in South Africa" for the information of our readers. Attention is drawn to the fact that, unless a constant supply of separated milk is available it is not considered advisable to embark on a milk-maize-meal system of feeding.—Ed.]

In order to ascertain the extent to which separated milk could be used in the daily ration of the laying hen, a demonstration was commenced at the Cedara School of Agriculture on the 14th May, 1930, with four groups of white Leghorn pullets, each group containing 100 birds.

Groups No. 1 and 2 were placed in one intensive house and groups No. 3 and 4 in another, both houses being subdivided. Each subdivision was 20 by 20 feet thus allowing 4 square feet of floor space per bird.

The division of the 400 birds in the demonstration was based on the question of future egg production as determined by the physical handling of the birds so that groups No. 1 and 2 comprised high, and groups No. 3 and 4 low, intensity layers.

Groups No. 1 and 3 were fed the following rations:—Dry mash open in hoppers all day supplemented with mash moistened with water, and crushed yellow maize as a scratch feed. The mash consisted of wheaten bran 100 lb., pollard 150 lb., mealie meal 150 lb., pure meat meal 100 lb.

Groups No. 2 and 4 were fed a "farmer's ration" consisting freely of sour separated milk and crushed yellow maize as a scratch feed, but no mash either dry or moist. In both these sour milk and maize pens no water was supplied.

All groups were fed a normal amount of green food, approximately 10 to 12 lb. per group per diem. In summer chaffed Kikuyu grass was used and in winter Chou-Moellier. A constant supply of shell grit was available in each house, also scratch litter to the depth of six inches on the floor. Pens No. 1 and 3 were given drinking water but no milk. As previously stated all groups were in intensive houses and had no liberty throughout the demonstration.

The quantities of mash, grain, milk and shell grit consumed were as follows:

Group 1.—Mash, 3,710 lb.; grain, 2,285 lb.; shell grit, 216 lb.

Group 2.—Separated milk, 1,435 gallons; grain, 3,791 lb.; shell grit, 242 lb.

Group 3.—Mash, 3,095 lb.; grain, 2,315 lb.; shell grit, 174 lb.

Group 4.—Separated milk, 1,243 gallons; grain, 3,069 lb.; shell grit, 194 lb.

The total egg production for each group for the period from 14th May, 1930, to 13th May, 1931, was as follows:—

Group 1, standard ration, 17,188; average per bird 171.88; group 2, milk and maize, 17,498; average per bird 174.98; group 3, standard ration, 11,045; average per bird 110.45; group 4, milk and maize, 12,249; average per bird 122.49.

In connection with the above figures it must be noted that groups 2 and 4 were placed on the milk and maize ration right away from a standard ration of mash and grain, and consequently went into a complete moult. The total taken from 14th August, 1930, to 13th May, 1931, when the hens in groups 2 and 4 were in full production, was a follows:—Group 1, 13,223; group 2, 14,459; group 3, 8,786; group 4, 10,042.

Feeding.—In groups No. 1 and 3 the dry mash hoppers were never closed, and in all the groups the quantity of yellow maize fed was gauged by the daily consumption. This was fed twice daily at 7 a.m. and 3.30 p.m., and just sufficient given to the birds at each feed to clear up readily in 15 to 20 minutes. When in full lay the birds in the

maize-and-milk group were fed approximately half this ration in V-shaped wooden troughs.

In groups 2 and 4 sour separated milk was always before the birds. The daily average consumed by 100 birds was approximately 4 gallons. In hot weather 5 to 6 gallons daily per 100 birds, and in winter 2 to 3 gallons per 100 birds was required. If a constant supply of milk is not likely to be available throughout the year or a fairly large portion of it, the scheme should not be attempted.

In feeding for egg-production a sudden change of ration or house is fatal. If a change of food is to be made, it must be done very gradually. Pullets to be placed on this ration must be made gradually accustomed to it when about 4 months old. This may easily be done by supplying both milk and water in different receptacles and gradually increasing the former while at the same time decreasing the latter until completely withdrawn.

The same applies to the mash and maize, the mash being gradually withdrawn.

Breeding Stock.—Eggs from breeding stock on the maize and milk ration are now being incubated and fertility is proving satisfactory. Chickens will also be reared on this ration to maturity. The results obtained will be published in due course.

Conclusion.—So far the demonstration has proved very satisfactory, and this method of feeding the laying hen should appeal to the dairy farmers and others able to obtain the necessary supply of separated milk.

It will be noted that group 4, low intensity layers, on the milk and maize ration were also ahead of group 3 on a standard ration. But it will also be very evident that the high intensity layers as selected by physical handling put up considerably better records than the other two groups on similar rations, which goes to prove that breeding is quite as important as feeding.

Vegetable Growing in Southern Rhodesia.

CELERY CULTURE.

By G. W. MARSHALL, Horticulturist.

History and Importance.—Wild celery is to be found in Southern England, Europe and Asia. Very little is known concerning its early history, but it was probably not cultivated until after the Middle Ages. The many strains now in cultivation are the developments of recent years. In 1880 this vegetable was little known, and many people regarded it as a luxury only to be used on special occasions.

Although the nutritive value of celery is not high it is wholesome and palatable. Its uses are varied; the leaves are excellent for garnishing and seasoning, and the seeds may be used to flavour soups, salads, pickles and other dishes. The thick, fleshy leaf stems are eaten raw, combined in salads or cooked, seasoned with cream or butter and served like asparagus.

Very little really good celery is to be seen on our markets in Southern Rhodesia; most of the supplies are of an inferior nature only suitable for flavouring purposes. This is rather remarkable when it is considered that our climate throughout the greater portion of the year is ideal for its growth. Celery grows best in areas with low atmospheric humidity (diseases are less troublesome), plenty of sunshine and warmth by day (for rapid growth) and cool nights (which make the crop firm and crisp).

These conditions are common in many of our districts. A better knowledge of the crop's cultural requirements, which, it is hoped, will be imparted in these notes, should

greatly improve future supplies both in regard to quality and volume. Furthermore, supplies should be available for several months of each year.

Botany and Varieties.—Celery belongs to the family of plants known as *Apiaceæ*. It is usually biennial, although if the seed is sown too early the plants may be checked in their growth and seed the first year.

Celery may be grouped under two general classes, namely, the green varieties and the so-called self-blanching varieties. The latter class is of most importance, as it comprises about 80 per cent. of the commercial plantings in celery producing countries.

No hard and fast rule can be laid down as to the varieties best suited to the many districts of this Colony. Growers have been restricted to the limited selections catalogued by their seedsmen, and it may be advisable for them to continue planting these varieties until such time as better selections are on offer. The varieties obtainable in Southern Africa are Solid White, Improved White Plume, Mommoth White, Coles Crystal White and Invincible White. Other varieties that deserve trial when procurable are: Golden Leaf Blanching (the favourite American variety), Winter Queen, Boston Market, Emperor, Easy Blanching and Newark Market.

Since great care and skill is required in the growing of celery seed, gardeners should purchase their requirements from the most reliable seedsmen. The planting of high-grade seed is of first importance; poor seed may cause hollow and pithy stalks or plants which run prematurely to seed.

Soils and Soil Preparation.—Any fertile soil that is deep and well-drained is suitable for planting to celery. Sandy loams are best, but good crops may be produced on heavy soils if they are well trenched and manured. Virgin land is generally unsuitable; it should first be planted to some other crop. The best results are obtained on soils that have been thoroughly dug or ploughed and brought into good tilth. With the poorer soils it will be advisable to dig or plough them twice to loosen the soil to the required depth (9 to 12 inches), and the second to mix the added manure or fertiliser in the upper 6 inches of soil, for the fact must not

be overlooked that celery is shallow rooted and will draw most of its food from this region.

Raising of the Plants.—In Southern Rhodesia celery seed may be sown between the months of August and February. It is seldom sown earlier than August, as the very early plantings have a tendency to run to seed prematurely.

The beds must be well prepared and brought into a fine tilth. The seed should be sown thinly in rows 2 inches apart and ⅛ inch deep. The beds should then be watered and covered with seed-bed cloth such as is used for tobacco beds, and with good seed and care germination will occur within 10 to 20 days. This covering should then be removed, for the seedlings will require plenty of light, warmth and fresh air. The beds should be watered every evening to keep the soil moist, but over-watering or watering during the heat of the day should be avoided, or it may cause the plants to damp off. When this occurs the plants should be watered with a solution of formaldehyde in the proportion of 6 ozs. to 5 gallons of water. If the stand is too thick the seedlings should be thinned to 1 inch apart, or they may be pricked out into other beds when the rough leaves appear. This pricking out often produces stronger and healthier plants, but they require to be protected by seed-bed cloth until re-established.

Manures and Fertilisers.—High quality celery can only be produced on soils that abound in vegetable matter, for if deficient in this respect the crop will be slow-growing and the stems will not be sweet, crisp and tender.

Well-rotted farm manure is the best material to supply this requirement, as it furnishes both plant food and humus. The amount of manure that should be applied varies with the nature of the soil. Fifty tons per acre is a common dressing for commercial celery growing in America. This amount may be excessive for this country, and half such a dressing should meet our requirements for ordinary soil conditions. Twenty-five tons per acre represents an application of 10 lbs. per square yard of ground. It may be necessary to reduce the amount of manure where the supplies are inadequate, in which case it may be desirable to supplement the shortage with commercial fertiliser.

When such fertilisers are used the dressings should be liberal and contain a fairly high percentage of nitrogen (4 to 8 per cent.), together with about 10 per cent. of phosphoric oxide and 8 per cent. potash.

One thousand pounds (1,000 lbs.) per acre or 1 lb. to 5 square yards would represent an ordinary dressing, but double this amount or even more may be used if conditions warrant it. Celery also responds to top dressings of nitrate of Soda, and these may be given when the plants are well established at fortnightly intervals in dressings of 50 to 150 lbs. per acre. Lime is also used in most countries, but the crop appears to do well in Rhodesia without it.

All manures or fertilisers that are added to the soil should be well incorporated in the upper 6 inches, since celery is, as previously stated, shallow rooted.

Planting.—As there is very little danger here from late frosts, the plants may be lifted from the seed beds for transplanting into their permanent beds or rows when 4 to 5 inches in height. If the plants are higher than this the roots should be cut back a little to prevent bunching when being planted.

It is usual to plant celery in well-prepared and moist beds, setting the plants 6 to 8 inches apart each way, and with from 5 to 10 rows per bed. Paths or alleys of 2 feet wide should be left between the beds. If the celery is to be blanched with soil, the plants should be set 6 inches apart in single or double rows, 3 or 4 feet between the rows, to permit of the intervening soil being drawn up to form ridges along the rows.

If the seed beds are well watered before the plants are lifted, more soil will remain attached to the roots and little or no damage will occur through injury or dying out. The plants should be lifted with care and transplanted during dull weather or late of an afternoon. Dibbers or trowels are used to make the holes for planting; the trowel is best, as is permits of making a larger hole to receive the soil-encased roots. The plants should be set the same depth as they were in the seed beds, and should then be well firmed and watered.

Cultivation.—If the celery beds or rows are well mulched with horse manure or old rotted vegetable matter there will be no necessity to cultivate. Weeds that grow through the mulch should be hand pulled. It is not, however, always possible to mulch until some time after the celery is planted, and in cases such as this the soil should be well loosened (when in suitable condition) after each watering.

Irrigation.—The beds should be watered when necessary, preferably with watering cans fitted with medium roses, or water may be led along the rows in open ditches or over the entire surface of the beds. Celery, however, responds best to rain or overhead irrigation, and it is for this reason that watering cans are recommended in preference to the ordinary methods of surface irrigation.

No hard and fast rules can be laid down regarding the frequency of application; over-watering induces disease and under-watering results in the production of tough and inferior quality celery. Each grower must regulate the water supply to meet his own particular soil and climatic conditions. The writer has found hand-watering every other day or two weekly floodings sufficient for the heavier soils around Salisbury, the quantity of water applied equalling 8-acre inches per month—or 36 gallons every other day to a 5-row bed measuring 36 feet by 3 feet.

Blanching.—Well blanched, well grown and crisp celery is required, and it is with this end in view that close planting in beds is recommended, for with this method of planting the stalks are developed in a subdued light which destroys the green colouring matter (chlorophyll). Blanching also makes the stalks tender and crisp. In cooler climates earth is extensively used to blanch celery, and this practice produces a sweet and nutty flavour, which is unobtainable by other means. But it also unfortunately causes heavy rust infestation in the warmer climates.

Celery may also be blanched in storage or by artificial methods, but this practice is not recommended when the same result can be easily achieved in the field.

Blanching may be commenced when the first plantings are well grown, usually in January, and may be continued until the crop is matured. Another very simple and effective

method of blanching is by using boards of about 12 inches in width and 1 inch in thickness, the length being optional; the boards are set on edge on both sides of the celery row and then clamped together with wire or other suitable material. The open ends between the boards should be closed with old sacking or grass and a little loose soil placed along the bottom edges which rest on the ground; this will prevent the entry of light from this quarter. If the boards are carefully placed, blanching will be completed in 10 to 20 days, the shorter period during warm weather.

In place of boards thick brown paper may be used, which is cut into 12-inch squares and then wrapped around each plant stem and tied with raffia grass or any other suitable tying material; two or three ties may be necessary. Earthenware pipes or tiles are also used for blanching, but their cost is prohibitive to use in this country.

Harvesting.—The factors that determine the stage at which celery should be harvested are: The size of the plants; thoroughness of blanching; weather conditions and prices. If these are satisfactory, harvesting may be proceeded with. All celery should be lifted with a digging fork or spade; the roots may then be cut off with a knife and the plants placed in baskets or wheelbarrows for removal to the packing shed, care being exercised that the plants are not exposed to the sun or dry air; a covering of damp sacking will achieve this object.

Marketing.—When the harvested plants are received at the packing shed they should be carefully washed, and their outer leaves removed; root stubs should also be trimmed with a knife to a reasonably sharp end.

Care must be exercised in the washing process that pure water is used; this is necessary from a health standpoint, for most celery is consumed in its raw condition. When the celery has been well washed and dressed it should be graded according to size, diameter and degree of blanching, the culls being sold as soup vegetables.

The graded celery should next be tied singly or in bunches of 3 to 6 plants. When bunching, the butts should be tied before the tops; this gives it a better appearance. Tying may be done with raffia grass or tape; appearance is

the principal factor in effecting sales, and growers have only themselves to blame if they attempt to market poorly grown or ungraded produce.

If celery is to be sent to distant markets it should be carefully packed in suitable wooden crates, the best size being 24 inches by 24 inches by 12 inches. This size crate will hold about 12 bunches of 6 plants each.

Crates which are returnable should be lined with damp sacking or hessian. The bunches should be wrapped in clean paper and packed in such a manner that the butts and tops lay alternately; this will produce a neat and firm pack of one or more layers, according to the depth of the crates.

Packed celery requires a moderate amount of ventilation, and this may be obtained by leaving the ends of the paper wraps open and using coarse hessian for lining the crates.

Storage.—It is possible to store celery for a fairly lengthy period, but this is only advisable when the crop has to be harvested to prevent deterioration, or the supply temporarily exceeds the demand.

The most successful method of storage is that of lifting unblanched plants, allowing the tops to dry and then placing the plants on end, butts down, in a cool or moist store or cellar.

Celery will tolerate from 5 to 7 degrees of frost, and if there is a danger of late celery being frosted it should be lifted and stored for marketing later in the season, or when prices are more remunerative.

Tobacco Culture.

TRANSPLANTING OPERATIONS.

By D. D. Brown, Chief Tobacco Officer.

It is desirable that after transplanting the plants should make rapid and continuous growth, and it is therefore important that the land should be properly prepared and brought into as perfect tilth as possible. Virgin land is stumped, cleared and ploughed during the preceding season. Stumping is best done before the close of the rainy season, when the soil is thoroughly soft. A point to be remembered when stumping and clearing new land is that the timber should be drawn off the field—not piled there and burnt. If burnt on the field, the heavy ash residues left on the land will give rise to an uneven crop of tobacco. The newly-cleared field should be ploughed—usually about March or April—while the grass and vegetation are still green and full of moisture, and before the soil becomes too dry or hard. When handled in this manner it will be found that the land can be more thoroughly ploughed; all vegetation turned under is more readily decomposed and converted into humus, and the soil is rendered more friable and retentive of moisture. After lying fallow during the winter months, the land should be ploughed and cross-ploughed, and then harrowed with a heavy disc harrow, being finally brought into a good tilth by means of drag harrows.

The majority of tobacco soils of Southern Rhodesia are inclined to be rather shallow, and great care should therefore be taken in the ploughing operations so that only the top soil is turned over by the plough. A quantity of sub-soil brought to the surface through ploughing too deeply will have a detrimental effect on the crop.

Land which has already been under crop should, if possible, be ploughed as soon as the crop is harvested, so that a certain degree of soil moisture may be conserved, and that insect pests which are hibernating in the soil may be destroyed. Such land should be ploughed again during the early part of the following season and brought into good tilth just prior to planting.

In the case of all tobacco lands, whether virgin or previously cropped, it is imperative to secure a good tilth before planting. Whenever possible, the final ploughing and harrowing should be made when the soil has been moistened by showers of rain which fall at the commencement of the wet season, since any weeds coming up at this time will thus be destroyed and subsequent cultivation and weeding will be reduced to a minimum.

To complete the preparation of the land, especially in the case of the lighter types, it is necessary to form parallel ridges through the field. Ridging provides a greater depth of soil and consequently an increased area from which the plants may derive plant food, while drainage of the soil is also assisted. The spacing between the ridges is from 3 to 4 feet, according to the type of soil and of the tobacco being planted. Light soils used for producing bright tobacco are ridged at intervals of about 3 feet, while on heavier soils for fire-cured tobacco the ridges are usually 4 feet apart. If possible, the ridges should be made to run east to west, so that the plants will receive the maximum amount of available sunlight. In this matter, however, the contour of the field will be the deciding factor.

Ridges should be aligned so as to follow the natural drainage slope of the field. Should the land be steeply sloping, it is best to place the ridges diagonally across the slope in order to check the velocity of water flowing down between each ridge after rain storms. On the heavier type of soil ridging is not so essential as in the case of the lighter soil types. Suitable drains should be made where necessary to lead off storm water and to minimise the risk of soil erosion. Around each field a strip of ground (say, 20 feet wide) kept free from weeds and grass will assist in checking insect pests. When the outside edges of the field are straight, and suitable pathways are made at convenient intervals across the field, a

great deal of time and damage will be saved during the working of the crop.

Manurial Treatment.—Until exhaustive experiments have been conducted in regard to the fertilising of each type of soil used for tobacco culture, it is not possible to set down any definite recommendations on this subject. Owing to the diversity of the types of soil, their varying degrees of inherent fertility and lack of uniform treatment accorded in regard to tillage and cropping, it is only possible to deal with the fertilising of the crop in a general sense.

In this Colony the bulk of the flue-cured bright tobacco crop is produced on light sandy soils derived principally from granite. These soils are not of a naturally fertile type, but they respond satisfactorily to suitable applications of fertiliser. The quantity of fertiliser to be applied per acre depends upon the inherent fertility of the soil and upon the proportions of the several elements of plant food used in the fertilising mixture. It is false economy to apply light dressings of fertiliser, for the plants in this instance may get a good start, but there may not be sufficient plant food available to produce a normal yield of tobacco. Light applications of fertiliser tend to produce plants on which the leaves are undersized and lacking in body. The leaf is bright in colour but the returns are poor because of the low yield per acre.

Detrimental effects are also caused by too liberal an application of fertilisers; in this instance it induces a coarse, rank growth of leaf which is generally late in maturing, difficult to cure and is of indifferent quality. Tobacco of this class is also more susceptible to attack by bacterial and fungoid diseases when such are prevalent.

In deciding upon the rate of application of fertilisers, it is therefore advisable to adopt a middle course and to have the dressing neither too light nor too heavy. Medium quantities will, on the average, produce the most profitable crops. The dressing of double complete tobacco fertiliser usually recommended for the ordinary sandy soil of medium fertility is about 175—200 lbs. per acre. The above rate of application requires some modification where the soil is much above or below the average standard of fertility. On very poor soils the quantity of fertiliser is increased, and on

soils above medium fertility the quantity is reduced to less than 175 lbs. per acre for bright tobacco production. If lower grade fertilisers are used, the bulk of the dressing should be proportionately increased. Good results have been obtained from fertilisers in which the nitrogen is derived from a combination of both organic and inorganic constituents. The water soluble components of the double complete tobacco fertiliser are as follows:—

Phosphoric oxide (P_2O_5)	20 per cent.
Nitrogen (N)	7 per cent.
Potash (K_2O)	10 per cent.

In commercial fertiliser mixtures manufactured according to the above formula a proportion of the nitrogen is, in some cases, present in organic form, whilst in other cases all the nitrogen is derived from inorganic sources.

The fertiliser mixture generally used on the lighter types of soil used in the production of flue-cured bright tobacco has the following formula:—

Phosphoric oxide (P_2O_5)	18 per cent.
Nitrogen (N)	6 per cent.
Potash (K_2O)	8 per cent.

The nitrogen in this mixture being derived from a combination of organic and inorganic nitrogenous components.

The requirements of the dark fire-cured tobacco are furnished by application of from 400 lbs. to 500 lbs. per acre of a fertiliser mixture having a formula such as the following:—

Phosphoric oxide (P_2O_5)	12 per cent.
Nitrogen (N)	6 per cent.
Potash (K_2O)	8 per cent.

Special mixtures, according to any particular requirements desired by individual tobacco planters, are manufactured by the local fertiliser companies.

Method of Application.—Fertilisers may be applied broadcast and harrowed into the soil before the field is planted, or else applied in drills; this, however, is not the common practice in this Colony. The usual practice here is either to apply the fertiliser to the land shortly before planting the crop or just after the young plants have become

established in the field. When applying fertilisers before transplanting, shallow holes are made at the correct spacing along the top of the ridges. The hand hoes used for this work should have handles cut to the same length as the proposed distance between the plants, thus providing a convenient measure. After the holes have been made, the requisite quantity of fertiliser is then mixed with the soil at the bottom of each hole. When planting out the tobacco, the transplants are placed in the depressions where the fertiliser has been applied.

If the application is to be made after the crop is transplanted, the quantity of fertiliser required for each plant is carefully measured out and then thoroughly mixed with the soil around the plants. The fertiliser should be placed about six inches away from the plants, otherwise damage to the roots of the tobacco may result. It has been found that tobacco grown on land fertilised before planting matures more rapidly than when fertiliser is applied after planting.

When kraal manure is used it should be applied broadcast at the rate of about 8 tons per acre, and thoroughly incorporated with the soil through ploughing. The manure should be old and well decomposed. It is best applied several months in advance of the transplanting season.

Time for Transplanting.—When tobacco seedlings are about six inches in height they are ready for transplanting. Tobacco of desirable quality is rarely produced from unsuitable plants, and the yield in most instances is disappointing. Growers sometimes use plants which are less than four inches in height; these are too small, and fail to make satisfactory growth unless the weather conditions are particularly favourable.

A few hours of hot sunshine immediately after transplanting will either kill or seriously retard the growth of such small plants, while a heavy fall of rain may cause them to become buried in the soil. On the other hand, overgrown, tough and woody plants are often transplanted in order to complete the intended acreage. As a rule lanky plants do not make satisfactory growth; the flower head develops while the plant is still small and, after topping, the leaves remain undersized and do not ripen normally. Optimum results can hardly be expected unless the tobacco

is transplanted during the most favourable portion of the season. The highest returns from flue-cured tobacco in Southern Rhodesia are usually obtained from the crop which is transplanted during the latter half of November and up to the end of December. Flue-cured tobacco planted in this Colony after late January and during the month of February seldom produces leaf of high value. Tobacco transplanted during the months of November and December will grow rapidly and reach maturity while the weather is still warm and before the rains have ceased; the leaf yellows well on the land and will cure more readily and be of good colour, texture and body.

The reverse is the case when the crop is transplanted late in the season; the plants then usually reach maturity when the nights are cool and the soil and atmosphere dry, the leaf tending to be small, heavy, coarse, leathery, dark-coloured and difficult to cure.

The best time for transplanting dark fire-cured, air-cured and sun-cured types of tobacco is generally from the beginning until towards the end of January, as in this case it is desirable that the tobacco reach maturity after the heavy rains have ceased.

If it is found to be absolutely necessary to plant out later than the periods found to be most suitable, then that portion of the crop which is planted late should be given an additional application of quick-acting, water-soluble fertiliser in order to hasten the maturity of the plants.

Transplanting.—Transplanting is best done on dull, misty days, with frequent showers of rain, and every opportunity of transplanting the crop during such weather should be fully utilised. It is seldom, however, that the whole of the crop can be transplanted under these ideal conditions; the planting operations are controlled by the advent of rain, often in the form of local showers, and also to a great extent by the degree of moisture in the soil itself. It is not advisable to transplant tobacco unless the soil contains sufficient moisture to prevent excessive wilting of the transplants. Provided the soil is sufficiently moist, tobacco may be transplanted throughout the day, though the best time is during the afternoon, as the plants are then subjected to less intense heat immediately after transplanting.

The seedlings are transplanted at regular intervals along the top of the ridges, or in the rows when the field has not been ridged, the spacing of the plants being as indicated earlier in this article. Before the plants are removed from the beds the latter should be thoroughly soaked with water in order that the young seedlings may be pulled up without damage. The roots should be examined, and any diseased plants should be discarded; root gall-worm is the most common pest found on the roots of tobacco seedlings. The plants are carefully packed in suitable receptacles, then transported to the field. Care should be taken that the seedlings are protected from the direct rays of the sun, otherwise they may be rendered useless through sunburn. Before planting, all excessively long tap roots should be cut short, say to a length of about six inches.

The actual planting is accomplished by using a short pointed stick for making suitable holes in which to place the plants. These holes should be neither too large nor too small, but should be of a size which will accommodate the roots of the plant without difficulty and yet leave no unnecessary airspaces.

The plant is carefully inserted and then the soil is firmly pressed down around it. The tap root should on no account be bent up when the plant is being transplanted; plants with a bent tap root seldom make satisfactory growth. The heart of the plant should also not be placed beneath the surface of the soil. In order to check the work of the planters an occasional plant may be grasped by the tips of the larger leaves and, if properly set in the ground, the plant will remain undisturbed though the leaves may be severed by an upward pull.

In conclusion it may be stated that a poor stand of plants seriously reduces the yield per acre. An imperfect stand is mainly contributed to by unfavourable weather conditions, insect pests, disease or bad workmanship. Fresh plants should be transplanted to replace those which fail; such filling in should be accomplished as soon after the necessity arises as is possible. It is not advisable to fill in blanks when the adjacent plants have attained a fair size, for tobacco plants transplanted under these conditions fail to make satisfactory growth, being dwarfed and overshadowed

by the bigger plants; hence the importance of expediting the filling in of blanks. The average stand of plants should exceed 75 per cent. if profit is to result. Many difficulties which are experienced in the harvesting and curing operations can be traced to uneven growth of the crop in the field. Every endeavour should, therefore, be made to secure an even stand right from the time when the field is first planted. The exercise of suitable care at the outset will certainly minimise the difficulties which may arise during the later stages of the crop. The acreage to be transplanted should be in accordance with the available curing and housing facilities and also in accordance with the available labour supply and the market requirements.

SUMMARY.

(i) The land should be properly prepared in advance of planting operations.

(ii) The crop should be transplanted during the most favourable portion of the planting season.

(iii) Early planted tobacco generally produces the best tobacco.

(iv) Late planted tobacco costs as much to produce, but is of little or no value.

(v) A full and even stand secures a uniform and good yielding crop.

(vi) The acreage is governed by barn and housing accommodation and available labour supply.

(vii) The market requirements also determine the acreage to be planted.

(viii) Correct field work reduces the difficulty in curing and handling operations.

(ix) Aim for quality rather than quantity.

Foot and Mouth Disease.

SEPTEMBER, 1931.

Chibi District.—The only active infection in this district occurred north of the main Mashaba-Shabani road.

Victoria District.—One fresh outbreak occurred north-east of the Fort Victoria Commonage and four in the southern section of the district. The disease is still active in the Zimutu and Victoria Reserves, and is spreading slowly from kraal to kraal. In many cases it is of such a mild nature that it is very difficult to diagnose with any degree of certainty, and even when definite lesions are observed it is only in a very small percentage of the herd. At all other centres infection is rapidly clearing up.

Gwelo District.—Two fresh outbreaks in the immediate vicinity of Ruby Block in the southern section of the district. All the previously infected centres are now regarded as clean.

Selukwe District.—Two fresh outbreaks in the vicinity of the outbreaks which occurred during August in the south-eastern section of the district.

Chilimanzi District.—Two fresh outbreaks in the vicinity of Felixburg road. Infection still exists in the Chilimanzi Reserve.

Belingwe District.—Infection is spreading in the Belingwe Reserve. Very little infection remains at other infected centres.

Insiza District.—Two fresh outbreaks occurred in the eastern section of the district, but the areas involved are small.

Bubi District.—In the Inyati section most of the infected centres have cleared up. Infection is active at four centres, but has not spread out of the original cordon.

On the Shangani side of the district one fresh outbreak occurred, but the infection is confined to a small area.

Gwanda District.—Infection extended to two fresh sections on Shobi Block west of the Umzingwane River and is still active on the east bank of the Umzingwane River up to the Belingwe Reserve. Fresh outbreaks occurred north of the junction of the Mchabezi and Umzingwane Rivers on what is known as Kivalas country; on the Dendele and Whunga Rivers, on the north-eastern section of Elwes Block and on the farm Tygerberg.

Charter District.—No fresh outbreaks. All previously infected centres now cleared up.

Mazoe District.—A slight extension of infection occurred in the Chiweshe Reserve. All the previously infected centres have cleared up.

Two fresh outbreaks in the immediate vicinity of existing infection. At these centres the disease spread slowly through the respective herds and at the remainder no signs of infection were observed.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

SEPTEMBER, 1931.

Pressure.—Barometric pressure was generally above normal, except in the south. Bulawayo recorded 2.1 millibars above normal and Mazunga 0.6 millibars below normal.

Temperature.—Temperature was generally above normal, principally in the maximum temperatures; the minimums recorded varied about normal.

Rain.—Very few showers were recorded in September.

SEPTEMBER, 1931.

Station.	Altitude	Pressure 8.30 a.m.	Temperature ° F.						Humidity, 8.30 a.m.		Precipitation.		
			Absolute.		Mean.			Diff. from Normal.	Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min.						
Bulawayo ...	4,440	873.0	96.0	37.9	83.8	52.0	67.9	+0.7	52.1	43	...	−.2	...
Gwelo	4,632	865.8	94.0	41.0	83.3	52.8	68.1	+0.7	52.3	33	...	−.2	...
Riverbank ...	4,100	...	101.0	43.0	88.5	55.2	71.9	+1.4	53.9	44	0.02	−.2	1
Essexvale ...	3,828	...	103.0	38.0	89.0	50.8	69.9	+0.9	53.5	52	0.02	−.2	1
Gwanda ...	3,235	909.1	100.0	43.0	85.6	53.9	69.8	...	56.7	45	...	−.2	...
Mazunga ...	1,970	951.1	105.3	36.5	88.5	53.2	70.9	−0.4	57.5	47	...	−.2	...
Nuanetsi ...	1,630	...	106.0	35.0	88.6	51.0	69.8	...	58.5	68	...	−.2	...
Between Rivers	3,970	...	96.2	39.9	87.4	51.8	69.6	...	54.1	43	0.01	−.4	1
Enkeldoorn ...	4,720	...	93.0	39.0	82.4	52.3	67.4	+0.9	53.9	35	...	−.1	...
Gatooma ...	3,850	...	98.0	40.0	87.9	52.3	70.1	−0.9	55.1	33	...	−.1	...
Miami	4,090	...	92.0	45.0	84.0	56.6	70.3	...	...	...	...	...	...
Salisbury ...	4,865	859.0	91.3	39.5	82.3	54.6	68.5	+2.1	52.6	37	...	−.3	...
Sinoia Citrus ...	3,830	...	...	...	...	...	...	...	...	...	...	...	...
Sipolilo... ...	3,900	...	94.0	49.0	83.7	59.4	71.6	...	55.8	35	...	−.1	...
Juliasdale ...	6,070	...	85.7	36.3	74.7	48.7	61.7	+1.6	52.5	33	0.06	−.3	2
Mtoko	4,210	...	89.0	45.0	80.2	57.5	68.9	...	55.9	45	...	...	...
Shamva ...	3,170	...	96.0	43.0	87.0	53.8	70.4	−0.2	...	...	...	−.1	...
Angus Ranch ...	2,300	...	102.0	44.0	87.4	59.3	73.4	+2.5	58.5	50	...	−.1	...
Craigendoran ...	3,430	...	99.0	42.0	88.1	54.2	71.2	...	...	...	...	−.2	...
New Year's Gift	2,700	...	99.1	45.9	84.2	55.9	70.1	...	57.2	54	0.10	−.2	3
Nyamasanga ...	5,080	...	...	...	...	...	...	...	...	...	...	...	...
Riverdene North	3,700	...	99.0	33.0	85.5	46.5	66.0	...	...	...	0.01	−.3	1
Stapleford ...	5,450	...	82.0	32.0	71.7	45.5	58.6	...	53.1	50	0.26	−.5	2
Umtali	3,677	895.8	92.0	44.0	80.8	55.1	68.0	+0.8	54.8	40	0.01	−.5	1
Victoria ...	3,570	898.4	97.0	38.0	83.4	49.7	66.6	+0.5	54.9	43	0.02	−.2	1
Melsetter ...	5,060	852.8	90.0	40.0	78.1	53.2	65.7	...	54.4	38	0.11	−.4	2
Mount Selinda	3,520	...	95.0	35.0	78.7	55.5	67.1	...	60.2	61	0.59	−.5	4

Farming Calendar.

November.

BEE-KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally, where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required, artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must be resorted to in order to keep the trees in good growth and to prevent any check to fruit development. This is a good month to plant green crops. Sunn hemp is possibly the best crop to smother weed growth and supply humus-forming material after it is ploughed in. If not already done, storm drains should be made on the sloping ground to prevent erosion of the surface soil during heavy storms. Where new plantings are contemplated, the holes should be dug and everything got in readiness for planting if the trees are ready for lifting in the nurseries. All unthrifty trees could with advantage have an additional amount of fertiliser and manure applied during the month. Keep down all water shoots.

CROPS.

Take note when the first rains fall, and see what leaks there are, if any, in the farm buildings. Do not neglect to effect such repairs as are necessary. Early in the month see that the planters are in perfect order, and that they drop the different seeds to be planted evenly and at the right distance. Try them out on the farm road. Hasten the work of getting the lands for early sown crops into as good a condition for seeding as possible, so that the first and most favourable opportunity for planting may be seized. The young plants make more rapid growth in a good seed bed. Utilise exceptionally early rains for this purpose rather than for planting. The holes for check-row planting of maize can continue to be prepared until sufficient rain has fallen to allow of planting. Velvet beans and dolichos beans for seed or hay may be planted dry if the land is in good order. With favourable weather, planting of maize, velvet and dolichos beans and cotton will commence about the middle of the month, and will continue as the condition of the land and the rainfall permit. Main crop potatoes should be planted from now on to January. Dhal may be planted for seed or green manuring—if for seed, a frost free situation is necessary. Kaffir corn for seed may be planted this month. Green-manure crops requiring a long growing season should be planted. Destroy, by feeding or burning, early planted trap crop of maize or volunteer plants which have become infested with stalk-borer.

If weeds are beginning to show, keep the harrows going in front of the planters. If weeds are too advanced to be killed by drag harrows and too numerous to be dealt with by hand labour, use the disc-harrow

or lightly re-plough the land. If the tilth is good, do not be afraid to harrow the young maize. This will save much labour later on by destroying the weeds while they are small.

DAIRYING.

In a normal year veld grazing should be plentiful in November, and the feeding of dairy stock is then very much simplified; veld grass in a green and succulent condition is practically all that is required for animals of less than average production. Heavy milking cows, however, on early pasture, require extra feed in the form of concentrates, while the latter should always be fed to dairy stock which are in poor condition at this time of the year. Young calves should not be turned out to graze with the herd, and in wet weather are best kept in a clean, dry, airy pen. Weaned stock, which have not hitherto had access to green pasture, should be gradually accustomed to the change in diet and may at first be turned out to graze for short periods. Young stock on pasture should also receive a small daily allowance of concentrates.

Farmers supplying cream to the creamery should adjust the cream screw to the separator so that the latter will separate a cream testing 45 to 50 per cent. butter fat. Cream of this consistency will keep better than thinner cream. It should be borne in mind that it is practically impossible to produce first-grade cream if the cattle are milked in a muddy kraal. In the absence of a cow shed, every endeavour should be made to erect a small milking shed in which four or five cows can be tied, milked and fed. A small shed of this kind is also essential to obtain clean milk for cheese-making. Milking in a muddy kraal invariably results in a gassy, bitter cheese being produced.

The shelves of the cheese room should be scrubbed with boiling water and soda, and for the last rinsing a weak solution of formalin may be used. This should prove effective in controlling cheese pests.

DECIDUOUS FRUITS.

Continue thinning out fruit on the trees if a very heavy setting has occurred. A small amount of large-sized fruit is preferable to a large crop of small fruit. Thin down the inner growth of new shoots if they have a tendency to crowd each other, and stop all suckers and main stem growths as they appear.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are liable to suffer later from stalk borer. At Salisbury, crops planted after 27th November have escaped serious injury, but early December plantings are probably the safest. Volunteer maize is commonly badly infested and should be cut out and removed immediately, otherwise the borers tend to spread to surrounding plants. If rain has fallen sufficiently early, lands may be baited at the end of the month against surface beetles, snout beetles and other pests which tend to reduce the primary stand of plants. The formula is arsenite of soda 1 lb., cheapest sugar 8 lbs., or molasses 1 gallon, water 10 gallons. Dip chopped Napier fodder or other green stuff and distribute broadcast. The poison may be sprayed over volunteer maize and weeds on land with good effect. Cutworms do not usually appear in numbers until December, except in low-lying land. Succulent green stuff soaked in a 2 per cent. solution of sodium fluoride is the most recent formula for poisoned bait, but destruction of these pests is difficult. Keep the land clear of weeds as a preventive measure. If the young plants are attacked by the black maize beetle (heteronychus), the only remedy is to destroy by hand. Good, clean farming will control these pests to a large extent.

Tobacco.—This crop is subject to many pests in its early stages, although attacked by a few after vigorous growth has started. Keep cheese cloth covers on seed beds at night to exclude pests, and spray regularly with arsenate of lead (powder) 1 lb. in 30 gallons of water to

protect against leaf-eating insects, etc. Lands may be baited against surface beetles with maize bran moistened with arsenate of soda 1 lb. in 30 gallons of water. Distribute in balls about the size of a golf ball and cover over with branches or anything to protect from sun. Place one ball to each ten plants and moisten again when dry.

Potato.—The first brood of leaf-eating ladybirds appear in November. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water. Spraying is also useful against the black blister beetles, which sometimes attack the crop on sandy soils. Keep the soil of irrigated crops well hilled and in friable condition as a precaution against tuber moth laying eggs on the tubers.

Kitchen Garden.—Plants of the cabbage family are liable to attack by diamond-back moth and other leaf-eating insects. When considered desirable, young plants may be dusted lightly with arsenate of lead (powder). Cabbage aphis may be kept in check by liberal watering and frequent washing with a forceful stream of water from a hose pipe or spray pump. Drenching the plants regularly with cold water is also held to be a good remedy for the diamond-back moth mentioned above.

Deciduous Fruits.—Young trees may need spraying with arsenate of lead (powder) 1 lb. in 20 gallons of water as a protection against chafer beetles, whose attack may check the growth very seriously. Choice varieties of early peaches may be netted to protect them from fruit-piercing moths.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to do excellently in this Colony:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox, Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkin, mealies, peas and potatoes.

FORESTRY.

Sowings of eucalypt (gum) seed should be made for late planting. If fresh seed of cedrela toona is available, sowings should be made. Keep the seed beds moist and free from weeds. The tap roots of early seedlings may be cut back in order to form hardy, stocky plants most suited for planting. Continue with pricking out if transplants are to be used.. Prepare all land to be planted by cross-ploughing and harrowing. A well prepared soil is a good fertiliser; it assists establishment and reduces failures.

POULTRY.

Some birds will now be commencing to moult. This will cause a decrease in the number of eggs laid. The poultry keeper, therefore, should see that his birds come through the moult as quickly as possible. Some birds will lay and moult simultaneously, but these are the strongest, most vigorous

and the best layers; the majority do not. The process of moulting is a natural one, but it is a severe strain on the system. Fowls that are not too fat, and can stand extra feed at the commencement of the moult, come through it best. More green and animal food should be given, and the utmost care taken that they are not exposed to cold or wet, otherwise they will not only take longer to moult, but go off in condition. A little linseed stewed, or linseed meal, or ground nut meal and milk should also be given. There will next month be a demand for table birds, and such as the poultry keeper intends to sell should be selected. In making this selection, it is no use choosing old or scraggy birds, for it is hopeless to attempt to fatten these, or make them good table birds. Do not coop them up till a fortnight or so before they are to be sold; give them free range and feed them well, with at least one feed of soft food mixed with milk once a day. Turkeys destined for the Christmas market should have free range, but also a feed of soft food once a day, and a good feed of mealies in the evening.

STOCK.

Cattle.—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or maize daily. The grazing should be improving rapidly in feeding value. If normal rains have fallen, the grass should be sufficient for cows of average production. Heavier milkers should be fed concentrates at the rate of about 3 lbs. per gallon of milk produced over the first. In most cases maize meal alone will be sufficient for the purpose.

Sheep.—Dip sheep; put the rams to the ewes; keep the sheep on high dry land; be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

TOBACCO.

Continue to sow seed beds, watering, etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out. Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity. Cultivate fields as soon as plants are established, to keep down weeds.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery, gradually gathering to burst in thunderstorms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy downpours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows. In a normal season the rainfall varies from two-and-a-half to three inches in Matabeleland, and from three-and-a-half to four inches in Mashonaland generally, with the exception of the eastern border, where it amounts to five inches. Between the rain periods and prior to the commencement of the rains, severe heat is likely to be experienced.

December.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished.

CITRUS FRUITS.

This is a good month to plant citrus trees into their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing maize after planting, this work should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for

ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken, as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants. Red soils may be baited with chopped Napier fodder or other suitable greenstuff dipped in arsenite of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grasshoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borer. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder) 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder) 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of Cedrela toona seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Expert, Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning, and during the second and third weeks three meals a day, each one containing, in addition to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Ranching cattle should not require any attention beyond dipping, but any stock that are in weak condition will be the better for a little hay or a pound or two of maize at night until they have regained strength. The bulls should be returned to the herd either at the end of the month or in January, and it should be remembered that the better they are conditioned and fitted for their work the more hope there is of a good crop of calves. For this reason also every effort should be made to have all the female stock in strong condition. Dairymen will find that as the grass becomes lush and rank a supply of sweet veld hay, teff hay or, say, three pounds of crushed maize given in the sheds at night will enhance both the quality and quantity of the milk. This will be found to be the case more particularly in districts of heavy rainfall. Milch cows should be protected as much as possible from cold rains and hot sun. Yarding all night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of

protracted rainfall. The calf pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather. Dipping should be regularly attended to.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

Gwebi Produce Prices.

Hull-less oats	40/- per bag of 150 lbs.
Spanish Bunch nuts (unshelled)	15/- per bag of 75 lbs.
Spanish Bunch nuts (shelled)	60/- per bag of 180 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Majorda seed	1/1 per lb.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
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No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
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No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 581. Leguminous Crops for Stock and Soil Improvement in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 603. The Production of Maize in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
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No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.

No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 724. Ploughing by Tractor, by A. W. V. Crawley, M.E., F.G.S.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

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No. 757. Maize on the Sand Veld : Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea) : Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 777. Some Aspects of Cost of Production Studies in Agriculture, by Arthur G. Ruston, D.Sc., Department of Agriculture, Leeds University.

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No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

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No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.
No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
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No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.
Botanical Specimens for Identification.
Accelerating the Sprouting of Potatoes.

REPORTS ON CROP EXPERIMENTS.

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No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
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No. 246. Report on Crop Experiments, Gwebi Farm, Season 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
No. 342. Rotation Experiments, 1913-19, by H. G. Mundy, F.L.S., and J. A. T. Walters, B.A.
No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-20.
No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
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No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.
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No. 827. The Ideal Brooder, by F. Roberts, Assistant Poultry Officer.

The following pamphlets can be obtained from the Poultry Expert upon application:—

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Cold Weather: Treatment of Fowls in, by A. Little, Poultry Expert.
Tuberculosis, by A. Little, Poultry Expert.
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METEOROLOGICAL.

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No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.
Farming Returns for Income Tax Purposes.
Land Bank Act (price 1/-).
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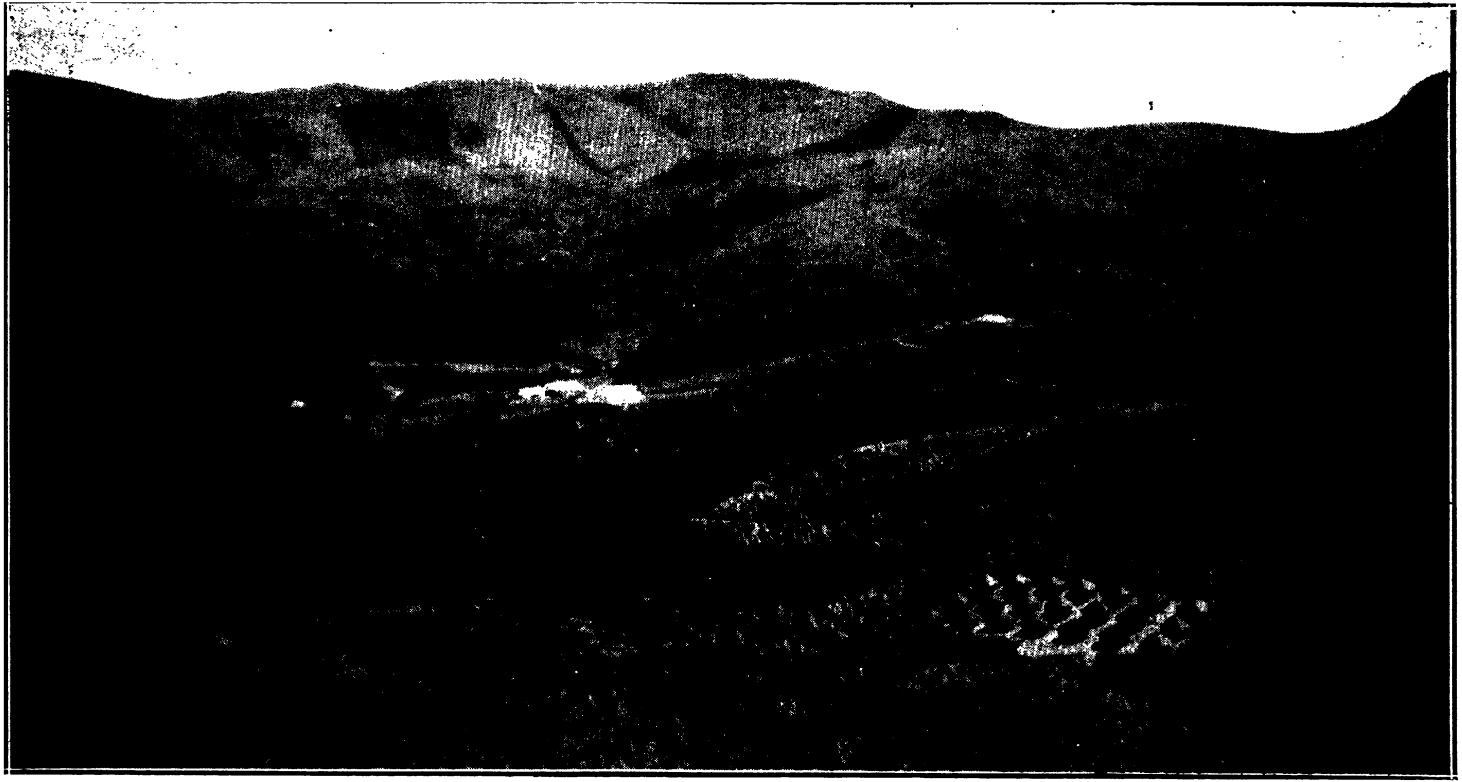
Summary of the Game Laws of Southern Rhodesia



Portion of Stapleford Forest Reserve.

THE RHODESIA

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Editor - - *William E. Meade*

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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and advertisements should be addressed to:—The Editor, Department of Agriculture, Salisbury.

The Timber Resources of Southern Rhodesia.—At this time, when the question of Rhodesian products is engaging the public mind, it may be of interest to note some facts about the Colony's timber resources. Available statistics reveal the dependence of Southern Rhodesia on other countries to a marked degree, which is perhaps surprising considering the well-wooded nature of the territory.

It is found that during the year 1930, this Colony imported wood and wood manufactures to the extent of over £305,000. If matches and paper are included, this figure would be increased by some £74,000, and could be still further augmented if such bye-products of forestry as resins and turpentine were added. It is significant that 52 per cent. of the total £305,000 was for imports from foreign countries, while in the matter of softwoods, which form the bulk of imported timber and represent half the value of imports,

under 27 per cent. were from British sources. The imports of hardwoods are represented mainly by furniture, £89,200; wooden sleepers, £48,400; brushware, tool handles and vehicle accessories, £16,500.

Southern Rhodesia has in her indigenous forests all the hardwoods necessary to fulfil her requirements. Lack of seasoning and preservative treatment, which are essential for the complete utilisation of these timbers, has been the chief reason why the Colony is not self-supporting. No indigenous conifers exist to meet the softwood demand, so that the planting of exotic species must be carried out if this state of affairs is to be reversed.

Fortunately this Colony has ample land admirably suited to the growing of softwoods, particularly along the eastern border, where climate, soil and rainfall meet all the requirements. The growing of softwoods on a commercial scale was started by the British South Africa Company in 1925, and by the Government in 1928, in areas typical of over half a million acres of eastern border forest land. The Government property, Stapleford Forest Reserve, comprises 60,305 acres adjacent to Portuguese territory, 30 miles north of Umtali, to which it is connected by road and telephone through Penhalonga. The soil is mainly a loamy sand of granite origin and great depth. The average annual rainfall is over 74 inches, of which the major portion falls during the summer months. Mists are frequent, even during the comparatively dry winter months.

The topographical features afford scenery of outstanding beauty. Rolling grassland downs on the main plateau vary with rugged steep slopes, covered, in the sheltered kloofs, with close-type high forest. In a span of some ten miles the altitude ranges between 2,500 feet above sea level, where the Nyamkarara River crosses the Portuguese border, and 6,750 feet on Mount Nuza. Perennial mountain streams bordered by forests of tree-ferns are numerous, and in time will afford the power necessary for exploiting the timber. It is not surprising that in this altitudinal range the climate varies from tropical to temperate. It is in the latter temperate high rainfall zone that afforestation of conifers is being carried out with such species as *Pinus insignis*, *Pinus*

patula, Pinus caribæa, Cupressus lusitanica, Cupressus torulosa and others.

In three years over 2,000 acres have been afforested, and it is intended to continue on this scale with the definite object in view of supplying the Colony's softwoods requirements. It is estimated that within eight years payable thinnings will be marketed, while final fellings will be carried out on a 20- to 30-year rotation, depending on the species grown.

The Union Deciduous Fruit Export Trade.—Some idea of the magnitude of the export trade in deciduous fruits from the Union of South Africa to the United Kingdom is gathered from figures issued recently by the Trades Commissioner in London. The total number of boxes exported in the season 1930-31 amounted to 1,845,495, which is 612,982 boxes less than in 1929-30. The principal fruits sent to the United Kingdom were grapes, 652,111 boxes; plums, 440,743 boxes; peaches, 329,375 boxes; and pears, 302,545 boxes. Grapes show an increase of 30,229 over the 1929-30 figures, but pears were less by 689,691 boxes. Peaches fell short of the 1929-30 figures by nearly 100,000 cases. Prices ruled on the low side, and apparently allowed little profit to the grower.

A Fruit from Paradise.—How a "Pomegranate of Paradise," alleged to be the most exquisite fruit in the world, was brought to England by a botanist who penetrated into the heart of Persia in search of new plants was explained to members of the British Association who visited the John Innes Horticultural Research Institute, near London, at the recent Centenary Meeting. Mr. Darlington was sent to Persia by the Empire Marketing Board to find new plum stocks which might improve our present varieties. He travelled into unexplored regions accompanied by an armed guard. But his trophies consisted of roots instead of heads. The most prized specimen was a cutting of a rare seedless pomegranate, which is believed by the Persians to grow in the fertile valleys of Paradise. It consists almost entirely of luscious juice. This valuable specimen is now growing in Kew Gardens.

Umvuma-Enkeldoorn Wheat Exhibition, 1931.—As briefly mentioned in last month's Journal it has been decided to hold a Wheat Exhibition at the Court House, Umvuma, on Friday, the 11th December. The exhibition will be opened by the Honourable the Minister of Agriculture and Lands at 2.30 p.m. All exhibits must be in place by 9 a.m., and full particulars may be obtained from Mr. E. T. Palmer, the Native Commissioner, Umvuma, who has kindly undertaken to organise the exhibition.

There are nine classes numbered as follows:—

1.—Best bag of milling wheat on the show.
2.—Bag of milling wheat grown on vlei land.
3.—Bag of milling wheat grown under irrigation.
4.—Bag of seed wheat grown on vlei land.
5.—Bag of seed wheat grown under irrigation.
6.—Bag of barley grown under irrigation.
7.—Best sheaf of wheat 9 inches in diameter.
8.—Best bag of oats.
9.—Best bag of barley grown on vlei land.
10.—Best exhibit from single farm.

Special prizes have been arranged for, and there is to be a lecture at 3.30 p.m. and a dance in the Falcon Hall at 8 p.m.

It is gratifying to learn that the wheat farmers of the Fort Victoria district are also participating in this exhibition, and it is hoped that it will be a great success.

Mystery Diseases which baffle Scientists.—A new laboratory for the study of virus diseases in plants (built by the Empire Marketing Board) has been opened on the outskirts of Edinburgh. Here fresh attempts are to be made to solve a mystery which is baffling the best brains of science —what is a virus, and how does it cause disease? The definition of a virus is that it will pass through the finest porcelain filter that can be devised. It is too small to be seen or photographed. No one knows if it is alive or dead. The problem is urgent not only for the farmer and market gardener—potatoes are to be studied particularly at the new centre—but from the human and animal point of view; influenza, measles and infantile paralysis in man and foot

and mouth disease in animals are examples of virus-borne diseases.

At the recent British Association meeting Dr. H. H. Dale, F.R.S., the Medical Research Council expert, said that he believed viruses were living organisms. They seem to reproduce themselves in suitable surroundings. Others have suggested that viruses are on the borderline of life—neither alive nor inanimate. Some say they are chemical substances. A determined attack on the problem is being made at a dozen different centres, and Dr. Dale said that scientists may be on the verge of a discovery as epoch making as that of germs, which Pasteur discovered about 70 years ago.

Tobacco Gifts.—No better means of making known Rhodesian tobacco and increasing the sales thereof in the United Kingdom has been devised than the "Gift" system, and it is to be regretted that greater use has not been made of the facilities provided in the past in this respect. A judicious present of a box of cigarettes or tobacco may convert a large number of smokers to its use, who, in their turn, will convince others of the qualities of the Rhodesian product. This is a matter in which Rhodesians can do a great deal to help the local industry, and we commend to the attention of farmers and others the scheme displayed in the folder issued by the High Commissioner in London and sent by the Department of Agriculture to a number of growers in the Colony. Although the circular has special reference to the Christmas season, it should be noted that gifts of tobacco can be sent at any time.

All that is necessary is to send a money order to the Publicity Department, Southern Rhodesia Office, Crown House, Aldwych, London, with the names and addresses of the persons to whom the gifts are to be sent, specifying the nature of the goods required. The donor should also send his card to enclose in the parcel and his address, in order that the money may be acknowledged. There is a wide range of cigarettes and tobacco to choose from, consisting of Almond Blossom, for which the charge is 4s. per 100; Crown House, 4s. 6d.; Rhodian (standard size), 4s. 6d.; Rhodian (extra large), 5s. 6d.; and Rhodesian Turkish, 6s. 6d. per 100.

Of pipe mixtures there are Cotton's Empire tobacco (medium strength), 4s.; Rhodian mixture (mild, medium and strong), 4s.; Four-Square mixture (medium), 4s.; Melsetter Coarse Cut (mild, medium and strong), 4s.—all in boxes containing a quarter of a pound and very attractively got up with illustrations on the outside of Rhodesian scenes.

Flue-Cured Tobacco.—According to a report issued by the United States Department of Agriculture and reproduced in "Tobacco," the stocks of flue-cured tobacco reported in the hands of dealers and manufacturers in the United States on 1st July, 1931, were 676,752,000 lbs. The production is about 18 per cent. less than a year ago, but the stocks are 13 per cent. greater. The production of flue-cured tobacco in the United States has increased greatly in recent years. In the six years from 1924 to 1930 the production practically doubled in amount, having increased from 437 to 860 million pounds. This was at a more rapid rate than consumption was increasing, and stocks have in consequence accumulated. However, as long as domestic consumption and exports were expanding at their usual rates these increases in stocks were not considered burdensome. But when consumption failed to increase, the full force of these accumulations, combined with a record crop in 1930, created a very unfavourable market situation. The influence of these conditions has continued into 1931, and has been felt particularly in the case of the heavier and lower grades of tobacco.

World consumption of products made from American flue-cured tobacco in 1930 appears to have been approximately equal to that of 1929. This is in sharp contrast to other recent years, for until 1929 the consumption of these products in most countries had been making substantial increases each year. Figures for the early part of 1931 show no improvement over 1930, apparently continuing to re-act to the reduced buying power of consumers and the relatively high prices for tobacco products. In the United States, cigarette consumption to 1st July was about equal to that for the same periods in 1929 and 1930. Consumption for the month of July was about 10 per cent. less than for July, 1930. Consumption in the United Kingdom for the first six months

of 1931 failed to make its usual increases, while in many of the Continental European countries definite declines in consumption have been recorded.

Exports for the year ended 30th June, 1931, were 432,735,000 lbs., slightly larger than the previous high record established in 1929-30. The United Kingdom and China were the principal importing countries, together taking 75.7 per cent. of the total. Stocks of flue-cured tobacco in the United Kingdom at the three ports of entry, London, Liverpool and Glasgow, on the 31st July, 1931, were 12 per cent. larger than in 1930 and 23 per cent. larger than in 1929. The quantities on hand in the countries of Continental Europe cannot be definitely determined.

Vale.—In order to effect economy, the Director of Agriculture, Dr. Brain, will in future be responsible for the preparation and issue of this Journal, and the present Editor, Mr. William E. Meade, proceeds on leave as from 1st December, pending retirement. In bidding adieu to friends, known and unknown, whose kindly encouragement from time to time has been an incentive to him in his work of advancing the agricultural industry, he wishes them Godspeed and prosperity in their farming operations. During the twenty years he has held his present office he has followed with the closest attention the varying fortunes of the agriculturists in this Colony. He has rejoiced with them when times have been good—and there have been good times—and he has sympathised with them deeply when depression has raised its ugly head. He realises that the prosperity of this Colony is indissolubly bound up in the welfare of the farming industry. If the man on the land is unable to make a living and to raise a family in accordance with the ideals of our race, then the whole economic fabric of this Colony is in jeopardy, and it is unlikely that the objects of our great founder will be attained.

Times at present are bad, but we think a silver lining is visible in the firmament. Great things have happened in the Old Country. An Imperial spirit is abroad, and it will not be appeased until there is an effective economic unification

of the various parts of this great Empire of ours. As a producer of raw materials Southern Rhodesia will share in the prosperity which will result from a pooling of resources. This Colony has good friends in the new Ministry at Home, and we feel sure there will be a ready response to the oft-made gesture for effective co-operation in promoting the Imperial ideal. We feel that better times are in sight, and our last message to the farmers of this Colony and the neighbouring territories is to be of good cheer. Much will depend upon their readiness to take advantage of opportunities that will occur, but with a proper appreciation of the situation and an inflexible determination to overcome the obstacles which have hitherto prevented the consolidation of interests, British Africa should go forward to the great destiny which is indubitably hers.

HANDBOOK OF TOBACCO DISEASES.

Attention of readers is drawn to the fact that the Department of Agriculture has found it most inconvenient, with the present shortage of staff, to handle the local sales of this book. Arrangements have therefore been made with the Rhodesian Printing and Publishing Company for distribution by them throughout Southern Rhodesia. The book may be obtained from the Herald Store, Salisbury, price 4s., or, postage paid, 4s. 4d.

Veld Grass Silage: A Feature in Rhodesian Pasture Management.

By H. G. Mundy, Dip.Agric. (Wye), F.L.S.
Chief, Division of Plant Industry.

The Chief Chemist of this Department in his "Studies on the Improvement of Natural Veld Pastures" (*Rhodesia Agricultural Journal*, February, 1931) drew attention to the fact that investigations in Europe, in this Colony and elsewhere had established the fact that close and rotational grazing both increases the carrying capacity of a pasture and renders the grazing of materially higher feeding value.

Locally conducted experiments have shown that the grass on sections of natural Rhodesian veld, clipped monthly to simulate close grazing, contains considerably higher percentages of crude protein, phosphates and other minerals than similar grass allowed to grow and mature unchecked by grazing or mowing.

The truth of these findings is now probably recognised by most thinking stockmen in the Colony, but many may feel that the practical difficulties of putting such a system of pasture management into effect are too great to warrant its serious consideration.

The object of the present article is to dispel these doubts where they exist, and to indicate methods by which the end desired can be achieved.

Smaller Paddocks: A First Essential.—The incidence of stock diseases in the Colony, particularly East Coast Fever, has led to an immense expenditure on fencing, which has been of very little avail in improving the pasturage. For many years, the tendency was first to surround the farm with a ring fence, and to leave internal paddocking to the future. Even where paddocks have been provided, the areas enclosed

have generally been far too large, the stock being free to roam about, and during the plentiful grass season, to feed down the more palatable species leaving the less palatable grasses to grow unchecked and to seed. It is hardly an exaggeration to say that much of the existing fencing in the Colony results in more harm than good to the pasturage and that no real improvement can be effected until smaller paddocks enable controlled grazing to be practised.

The high costs of fencing is a deterrent to close paddocking, but on most farms there are existing fences which could be taken down and utilised for sub-dividing large paddocks into smaller ones, without in any way reducing the stock carrying capacity of the holding.

Close and Rotational Grazing.—If short, frequently-grazed grass possesses so much higher feeding value than a more mature growth, the essence of the methods of pasture management now advocated lies in the rapid and even grazing down of each area of grassland, followed by a resting period during which re-growth will be made. This must be followed again by further grazing and resting periods, and so on throughout the year, as far as seasonal conditions permit.

The principle difficulty of such a system in this Colony is the excessively rapid and luxurious growth of the grasses during the early part of the rainy season, followed by the almost entire absence of growth from the time the rains cease —about April—until they re-commence in November or thereabouts.

These conditions normally result in a great surplus of grass in summer, over and above the requirements of the stock, the number that can be kept on the farm being limited by the carrying capacity of the veld in winter. A series of paddocks of the size commensurate with the head of stock of different ages and classes which can be turned into them will enable rotational grazing to be practised. But whereas any one of these paddocks may support a given head of stock for a week, in late November and again in March and April when grass growth is slow, the same number of animals will be entirely unable to graze down the pasture closely when the grasses are growing more rapidly. Heavier

stocking of certain paddocks during this period will only be achieved at the expense of under-grazing others, and thus no matter how carefully the plans made may be laid it is almost inevitable that in mid-summer much of the grassland will outgrow the rate at which it can be grazed down.

The period of rest allowed to each paddock will vary with the season of the year, the fertility of the soil and so forth, but in practice the aim will probably be to feed down the grass each time it attains a height of 6-8 inches.

If the pasture contains coarse, unpalatable grasses which are not grazed by the stock and which in consequence are out-stripping the other species and threatening to come into flower, the mowing machine must be employed towards the end of each resting period, to check these back and so render their re-growth more attractive to the stock when next turned in.

Mowing for Hay.—Occasionally in January, and almost invariably during February, opportunity will occur for converting surplus growth in some of the paddocks into hay. Everything should be in readiness to take advantage of these spells of dry weather when they come, and as much hay as possible should be made on these occasions.

The following analyses of Rhodesian veld hay, cut at different seasons of the year, are kindly supplied by the Chief Chemist and no clearer proof of the importance of making hay during the early part of the year can be needed. The subject was discussed very fully by the writer in the *Rhodesia Agricultural Journal*, February, 1928 (Bulletin No. 672), and it is not proposed to refer further to it in this article.

Analyses of Good Veld Hay.

	Cut beginning February.	Cut beginning March.	Cut beginning April.	Cut beginning May.
Crude protein	6.33	4.73	3.72	1.95
Ash	10.68	8.13	7.18	6.57
Ether extract	1.35	1.34	1.24	1.86
Fibre	38.00	43.61	43.67	42.71
Carbohydrates by difference	43.64	42.19	44.19	46.91
	100.00	100.00	100.00	100.00

Grass Silage.—In spite of all that can be done in the matter of hay making, there will still be large areas of grassland on most farms fast outstripping the combined effects of grazing and mowing. This grass need not be wasted, nor need its high feeding properties be allowed to decline as was shown by the above table to occur if the herbage is left until April and May and permitted to mature. Surplus grass can be converted at any time during the rainy season into silage and if the modern system of grassland management is to be applied to Rhodesia, this practice becomes imperative.

Grass silage can well take the place of other succulents and it is probable, owing to its stimulative effect on the appetite, that better results will be obtained from feeding grass silage in conjunction with hay than by giving the whole grass ration in the form of hay.

The practice of ensiling grass is a revival of an old custom which is referred to as follows in "Steven's Book of the Farm," published in 1889:—

Page 306: "It appears to have been in Germany that the system of ensilage was first applied to the preservation of fodder crops, as distinguished from grain. So far back as 1843, Professor Johnston gave a detailed description of the German system of making 'sour' hay in an article in the *Transactions of the Highland and Agricultural Society;* and extracts from the article were given in two former editions of 'The Book of the Farm.' "

"In 1874, Professor Wrightson in his 'Report of the Agriculture of Austro-Hungarian Empire' published in the *Royal Agricultural Society's Journal*, remarked that 'the system of making "sour" hay is also well worth the attention of English agriculturists. It is done by digging graves or trenches, 4 feet by 6 or 8 feet in depth and breadth, and cramming the green grass or green Indian corn tightly down into them, covering the whole up with a foot of earth. The preservation is complete, and the wetter the fodder goes together the better. . . . This "sour" hay affords a capital winter fodder, and when cut out with hay spades it is found to be rich brown in colour, and very palatable to stock.'

Pages 315-316: ". . . once made some useful experiments in stack silage with our patent pressure. He put in

sixteen waggon-loads, the produce of about six acres, taking four days. After four days they cut down the sides, and added the trimmings to the top. The temperature was as follows: 3rd day, 90° Fahr.; 4th and 5th, 120°; 12th, 130°; 22nd, 135°; 43rd, 137°; 53rd, 140°. It remained at this heat for a month, when it gradually declined to 122° during six weeks, when it was cut out. With reference to the silage, he remarks as follows: 'The silage is turning out very satisfactorily, only 2 or 3 inches of mouldy stuff or waste on the outsides, with 2 to 5 inches of ditto on the top. The cows and horses eat it readily, cut out and mixed with hay and chaff.

" 'A stack we built at our works in Blackfriars reached a temperature of 156°; this had from 6 inches to 1 foot of waste on the outsides, the remainder being excellent. The loss from evaporation, however, was considerable, and was fully one-third of the weight put in.' "

The Principles of Silage-Making.—The term ensilage is given to the process of preserving green fodder in a succulent condition for feeding to stock during the winter months.

The principle of this process is the encouragement of fermentation of the plant sugars, which gives rise under favourable conditions to the formation of lactic and other organic acids. These acids act as preservatives and check putrefaction.

The resulting product is called silage and may be sour or sweet according to the manner in which it has been prepared.

From the actual feeding point of view there is little to choose between sour and sweet silage, although the latter may be more attractive to stock unused to this food.

One of the most important factors influencing the type of silage obtained is the temperature to which it rises, particularly during the initial stages of fermentation. Too much air or too little moisture results in a rapid rise in temperature and a considerable loss in dry matter due to very rapid fermentation.

The best results are obtained when the temperature of the silage does not exceed 140° F. This condition can be attained when the fodder is cut damp and is well compacted in the silo.

When the material put into the silo is too dry or in filling or stacking is insufficiently compacted, excessive heating and considerable loss will take place. On the other hand, when the fodder is very wet and the silo too rapidly filled and compacted, the temperature does not rise sufficiently, and insufficient air is available for proper fermentation to take place. The silage under these conditions may have a rancid and objectionable smell, rendering it unpalatable to stock.

Local Results.—Experiments in making grass silage were commenced last season on the Salisbury Agricultural Experiment Station and at the Gwebi Farm. At the former station, most of the material used consisted of the undermentioned grasses grown in pure associations:—

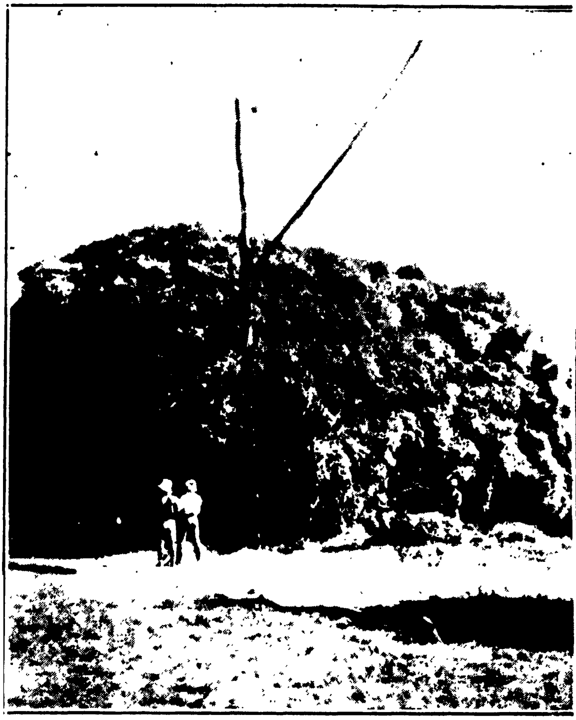
Rhodesian blue grass (*Andropogon gayanus*).
Wild paspalum grass (*Paspalum scrobiculatum*).
Rhodesian Timothy grass (*Setaria sphacelata*).
Reed Timothy grass (*Setaria phyagmitoides*).
Purple-top Buffel grass (*Panicum maximum*).
Red-top grass (*Tricholæna rosea*).
Hunyani grass (*Chloris gayana*).
Rooi grass (*Themeda triandra*).
Gonya grass (*Urochloa trichopus*).

The trial is reported upon as follows by the station manager:—

"The silage was made in a circular stack about 15 feet in diameter and entirely above ground. After adding material for four consecutive days, the stack was 8 feet high, and it was then left for two days to ferment, after which about 3 feet of fresh material was added each day for four further days. This material did not increase the height of the stack very much, since fermentation was rapidly taking place, and the lower part of the stack became more compressed with each additional load.

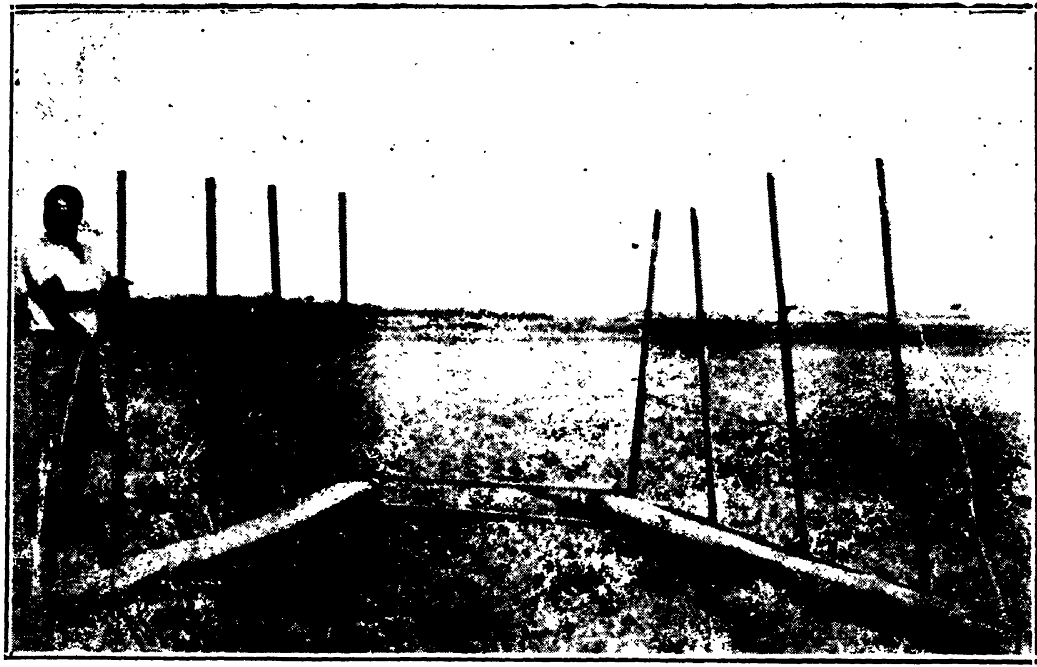
"The stack was then weighted with logs which after a few days reduced its height to about 6 feet, and at this stage the logs were replaced with a layer of soil 2 feet deep, the logs being used again to give additional weight.

"When the stack was opened, about the middle of August, it was found that all the fodder forming the outer



Gum pole derrick for lifting hay or green fodder on to stack. A pair of oxen are employed to pull up the load.

Scissor pinchers or "grab" of the derrick for grasping the fodder to be raised on to the stack.



Farm-made hay drag used at Gwebi.

belt of about 18 inches in width had decayed, so much so as to be unfit for stock food; another belt of about the same width was not in the best of condition, though it was subsequently eaten by cattle, but the central core, extending from the ground to the top of the stack, was composed of excellent silage.

"The upper layers of this core were somewhat 'sour' and dark in colour owing probably to copious showers of rain having fallen shortly before the stack was closed down, but the lower part consisted of sweet brown silage and resembled the best maize silage in colour and odour. The whole of the silage in the central core was very readily eaten by cattle.

"This silage was made during the last week in January; the grasses were then bearing seed and their culms had become somewhat fibrous. The quality would have been even better than it was if it had been made somewhat earlier, at which time the grass would have been less mature. Nevertheless, this trial clearly proves that grass silage of good quality can be made from the common veld grass, and that the whole growth of species whose coarse seed culms often render them undesirable for hay can be converted into excellent silage."

The subsequent growth of such grasses will be finer for their having been mown, so that, not only will the summer surplus have been stored before it has become coarse and unpalatable, but the aftermath will also be more palatable and nutritious.

Samples of this grass silage were exhibited on the Salisbury Show and were very favourably commented on by all who saw them.

At the Gwebi Farm the stack of grass silage was weighted insufficiently and a considerable amount of decayed and mouldy fodder resulted. The centre core was composed of good, sweet brown silage, and it is of interest to record that a number of pedigree Shorthorn cows (all in calf and imported from England two years previously) consumed both the best and the very inferior silage with equal avidity, and apparently with no ill effects, since calving has proceeded in the normal manner. These cows were in a paddock and had free access both to the silage and to good veld hay and oat straw, but they evinced a continued preference for the grass silage until the whole stack was consumed.

Analyses of Grass Silage Compared with Maize and Maize and Velvet Bean Silage.

	Kind of Silage.			
	Blue grass (*Andropogon gayanus*).	Veld grass.	Maize.	Maize and Velvet bean.
Crude protein ...	10.69	6.15	7.12	11.04
Ash	6.68	12.30	4.96	3.35
Ether extract ...	2.10	1.88	5.75	4.11
Fibre	39.86	38.62	9.59	13.98
Carbohydrates by difference ...	40.67	41.05	72.58	67.52
	100.00	100.00	100.00	100.00

The above analyses of silages made on the Agricultural Experiment Station, Salisbury, and calculated on 100 per cent. dry matter basis, have also kindly been provided for this article by the Chief Chemist. A study of the figures discloses the very important fact that the protein content of veld grass silage compares very favourably with that of maize silage, and that blue grass silage is even higher in this respect and approximates closely to the protein content of mixed maize and velvet bean silage.

The importance of the success attending these preliminary trials with veld grass silage can hardly be overestimated, and only those who have experienced the advantages of maize silage as a supplementary succulent feed for the dry season will fully appreciate the avenue to cheap feeding which grass silage opens up. There will, of course, be some loss of food ingredients during the conversion of grass into silage, but this loss will be negligible compared with that which occurs if the grass is allowed to seed and mature.

Making Grass Silage.—One of the chief costs of making any form of silage preserved in a pit or overhead silo is the expense entailed in getting the material into and out of the storage receptacle. The cheapening of costs of production

of stock feeds is an essential, and for this reason it is suggested that grass silage will usually be made in a stack above ground. The following notes on the building of stack silos have been compiled from various sources:—

A base measurement of 14 feet x 16 feet, with a height of 22-24 feet, should give a stack containing about 60 tons of silage.

Each layer of material must be built upwards and evenly, maintaining a regular and unbroken contour, to ensure an equal distribution of weight and in order that the stack will shrink evenly and maintain its shape.

Close and careful packing and tramping of the fodder is essential; firstly, to exclude air from between the layers of fodder as they are added, and secondly, to prevent air from entering the stack during the curing process.

The fodder should be stacked immediately it is cut, without being given any opportunity to wilt.

Lucerne, clovers, wheats, oats, barley, etc., cannot be too green and succulent for conversion into silage.

A waste of 12-15 inches of fodder on the outside of the stack is usually unavoidable, but the larger the stack the less the proportion of waste.

In the case of rectangular stacks, it is well to set at least four stout poles in the ground, one to retain each corner of the stack. Care must be taken to see that the sides abutting on the poles are as well and carefully stamped and packed as the remainder of the stack.

In six weeks a stack will usually shrink two-thirds of its original size.

When the stack is completed, adequate weight on the top must be maintained by some means, and it is suggested this may be effected by passing fencing wires over the stack about every 2-3 feet apart. Heavy logs or similar weights should be attached to these wires on each side of the stack and well clear of the ground, so that as shrinkage occurs the weight drawing down the wires will still be evenly maintained.

The base of the stack should never be made too big, as it is essential that the stack should be as high as is humanly

possible. The greater the height, the greater the density of the packing. The more air that can be excluded, the better the silage.

Grass can hardly be too young for conversion into silage, and the younger the growth, the higher the percentage of protein in the resulting fodder. The grassland may, therefore, be mown with advantage as soon as there is sufficient growth to cut and carry.

As already suggested, cheapness of production is most essential, and it is thought that where the making of grass silage in a stack is to be regularly adopted, large hay-sweeps and a "jib and grab" (or scissors), as used at the Gwebi Farm, should form a regular part of the equipment maintained for the process.

Much labour can thus be saved. The grass will be cut in fine weather or wet, will at once be drawn into wind rows with the rake and from there will be dragged to the stack by means of the sweep, when the "jib and grab" can be operated by hand or ox-power to hoist up the fodder. A portable jib or derrick has recently been used at Gwebi mounted on a small trolley or sledge, and this appears to offer further advantages, for the aim will generally be to build the stacks at various parts of the farm and in close proximity to where the grass has been mown.

Hillside Silos.—Under certain conditions, the hillside silo, when the configuration of the land permits, possesses advantages. Amongst these are the ease with which it can be filled from above and the reduced labour required to take out the silage. Moreover, as the silage is below or on a level with the ground, weights to cause the necessary compression can more easily be applied. The sides of the stack are protected from drying winds and sun.

With silos of this kind an excavation of the desired size is made in a convenient hillside. Often in retentive soils no timbering of the sides will be necessary, and all that will be needed is a timber front on the down-hill side of the excavation.

When gum poles or other suitable timber are available, the front of the pit may be constructed of poles laid horizontally between uprights, in such a manner that; as the

silage is taken out, poles can be removed, and the height of the silage in the pit is kept level with the top of the wooden front wall. By this means, no lifting of the silage is necessary. It requires only to be drawn off the top and thrown on to a wagon below. The wagon then daily carts the silage to the pasture where the stock are fed.

Arrangements should be made that the green fodder can be carted up the hillside to the top of the pit, from whence it may be thrown down into the silo.

The Value of the Aftermath.—The investigations of the Chemical Branch have demonstrated quite definitely that the aftermath produced by Rhodesian grassland mown in February has a feeding value at least as high as, and in many cases higher than, that of the normal growth of grass in December. On the other hand, uncut and ungrazed grass falls off rapidly in feeding value from the beginning of March until the beginning of May, and after that date is of very reduced value for the sustenance of live stock.

A process of close and rotational grazing, combined with the early mowing of surplus grass and its conversion into hay or grass silage, will enable the farmer to achieve the following ends:—

(a) The carrying capacity of any given area during the rainy season is increased.

(b) The nutritive value of the natural, untreated pasture is maintained at a higher and more uniform standard than it can be by any other means. Stock will therefore make better and more rapid growth, and will be afforded a longer period in which to make this growth before the grazing seriously deteriorates.

(c) The cutting of hay early in the season, and the conversion of the grass into silage, before it becomes too mature, improves the grazing by reason of the aftermath thus obtained, and at the same time enables the storage of surplus grass in a condition of high feed value and succulence, for use in winter.

(d) In normal seasons in the districts of heavier rainfall, grassland mown for silage in January will

yield a second cut for hay in early April, and this hay can be cured under very favourable weather conditions. Though the yield will not be so great as it would if a previous cutting for silage had not been taken, the feeding value of the hay will be considerably higher.

(e) As in the case of hay, grass for silage should be cut early and before it becomes too mature. By this means many of the essential mineral elements contained in the grass will be conserved in the silage.

(f) If the grassland of the farm is kept short, by the methods outlined above, the fear of grass fires becomes negligible, for, even should they occur, no difficulty will be experienced in putting them out.

(g) Given an adequate ration of grass silage and hay, the majority of cattle will winter well without recourse to additional feeds.

(h) The ultimate effect of very close grazing on the constituents of average Rhodesian veld is not known. Much remains to be learnt regarding the frequency and closeness of grazing which can be practised, and experiments to throw light on this subject are in progress. Meanwhile, there is no fear of a pasture being damaged by adoption of the methods outlined above, provided adequate resting periods are allowed and the herbage is not grazed so closely as to destroy the crowns of the plants.

MISSING NUMBER.

The University Library, Reading, England, is in urgent need of No. 4, Vol. xxviii. (April, 1931) of the *Rhodesia Agricultural Journal.* Will anyone who can spare this number kindly forward it to the Editor, Department of Agriculture, Salisbury.

Additional Notes on Grass Silage.

By R. LINDSAY ROBB, Grassland Specialist to Imperial Chemical Industries, Ltd.

In New Zealand to-day the greater part of the surplus grass growth is conserved as silage and it is no unusual occurrence to find farmers with two and even three years' supply of grass ensilage on hand. In Southern Rhodesia the need for conservation is much greater than in New Zealand because growth conditions are much more erratic here, and grass production, consequently, is much less uniform throughout the year. Grass silage can be made successfully and cheaply in pits or stacks, and there is no need to erect expensive tower silos for the purpose. There are, however, some important practical considerations if successful results are to be obtained, of which the following are of greatest importance:—

Silage making should begin as soon as grass growth gets ahead of the grazing animals, and for Rhodesian conditions it would appear that December may be the best silage month because during that month the surplus growth is considerable and the grass still retains its succulence and quality. The ideal stage for cutting is "long enough for easy handling with ordinary implements, but young enough to produce good quality silage."

A convenient size of stack is one of 15 feet diameter which will take 20 to 40 tons according to height. Round stacks are preferable to other shapes in order that wastage be reduced to a minimum. Sufficient grass should be cut in the morning to build a stack to a height of 6 feet or 7 feet the same day. It should then be allowed to settle until the temperature has risen sufficiently, when cutting and stacking is continued. It is frequently advantageous to have two stacks going simultaneously, as this permits of almost continuous daily cutting and stacking. During the process of building, the outside walls of the stacks should be kept firm by trampling, and the centre should be kept full, but not hearted up.

For those who have had no previous experience of silage making it is advisable to use a thermometer. This is placed in a piece of piping which is inserted in the centre of the stack after each building period and withdrawn again when stacking commences. If the temperature tends to rise quickly stacking should proceed more rapidly than in the case of more slowly rising temperatures. When finishing the stack the centre should be hearted up so that when earthed up the centre will be slightly higher than the walls. If during stacking there is a continuous wind blowing from the same direction very uneven settling may result, but this can be obviated by placing a large protective sheet on the windward side.

When the stack is finished it must be weighted to give uniform settling and control of temperature. This can be satisfactorily accomplished by putting any rough material—poor quality grass, etc.—on top and finishing off with a good layer of soil, which can be held in position by placing bags containing sand or soil round the walls of the stack.

Thirty tons of good green material should give about 20 tons of cured silage which will be ready for feeding in five or six weeks, but which will keep for several years if necessary. The same general principles apply to the making of pit silage. The pit should be 12 to 14 feet wide to permit of the load being drawn over it where this is practicable. When filled to 3 or 4 feet, allow to settle and proceed as for stack silage.

On flat country it is more convenient to make stack silage, but on undulating land excellent pit silos may be made at very little cost. These are filled from the top and the cured silage is carted out from the lower level.

Whether stack or pit silage is being made it is advisable to have a foundation layer at the bottom of some poor material to obviate wastage of good silage, and during the building of a stack the sides should be pulled and the material thrown on top. This also reduces wastage.

During the process of silage making salt may be used with advantage if the quality of the material is poor. From 4-6 lbs. of salt should be sprinkled on per ton of green material.

Tobacco Culture in Southern Rhodesia.

SEASONAL NOTES.

By D. D. Brown, Chief Tobacco Expert.

Cultivation.—Cultivation should commence as soon as the tobacco plants have become established in the field. The first cultivation should be shallow, in order to save the plants from being disturbed or injured. After the plants begin to grow properly, a deeper cultivation should be given so that the soil may be well stirred up and aerated. Subsequent cultivation should be shallow, otherwise the root system of the plants will suffer injury. The system of cultivation varies according to the type of tobacco and also to the method of planting. In the case of the Turkish type, all cultivation must be done by hand hoes. For the Virginia type of tobacco, animal-drawn implements are used. When planted on ridges, the cultivation of tobacco is best made by the alternate use of a wing-shovel plough and the ordinary cultivator. Where the crop is planted in check rows, the use of a ridging plough is dispensed with and a cultivator is used, so that each cultivation is at right angles to the direction followed by the previous cultivation.

Whatever be the means used for the cultivation of the crop, it is essential that these operations should be carried on as often as is necessary to keep the field free from weeds and to preserve a good mulch on the surface of the soil. Hand hoes should be used for clearing up around the plants and for the removal of weeds left undisturbed by the cultivator or ridging plough. Soil should also be drawn up around each plant in order to support the plant and cover the roots.

Cultivation should be continued as long as these operations can be effected without damage to the tobacco leaves. After the use of animal-drawn implements becomes impossible, hand hoes may still be used for removing any weeds and grass left growing in the field.

Priming.—The removal of surplus leaves from the lower portion of the plant is known as "priming." The first priming should take place when the plants are about 12 inches high. The lower leaves should be pinched off close to the stalk of the plant. Diseased or damaged leaves should be removed whenever they are noticed on the plant. The final priming of the tobacco is made when the plants have reached the correct stage for "topping." When finally primed, the plants should carry no leaves lower than about 12 inches above ground level. Sand lugs are of low commercial value and use up a certain amount of plant food which might otherwise be available for the better grade leaf growing higher up on the plant. High priming is particularly desirable in areas where "white mould" is prevalent. Diseased leaves should not be left in the field, but should be carted away and destroyed.

Topping and Suckering.—The operation of removing the terminal bud, to prevent the development of seed, is called "topping." There is a general tendency for growers to top their tobacco too high. The upper leaves of plants which are forced to carry too many leaves are very small and late in maturing. On the other hand, if topped too low, the tobacco develops coarse, heavy leaves, which are difficult to cure. Topping the tobacco requires both judgment and experience. The height of topping depends not only upon the type of tobacco being grown, but is also dependent upon soil and climatic conditions. The average height of topping for bright flue-cured tobacco is from 12 to 14 leaves, and dark fire-cured tobacco from 8 to 10 leaves. The Turkish type is left untopped. Air-cured tobacco is generally topped from 8 to 10 leaves. The proper time to top tobacco is when the requisite number of leaves have developed and while the stalk of the plant is still soft and supple. This operation should not be delayed until the flower heads are fully grown. When disease is present in the crop it is often advisable to top the tobacco a little higher than usual and also to delay

the operation for a short while beyond the normal period. About 10 days after topping, suckers will appear in the axils of the leaves, and these must be removed or the whole object of topping will be defeated. If suckers are allowed to grow, the yield per acre will be reduced and the quality of the cured leaf will be seriously affected. When a period of wet weather occurs just as the tobacco is ripening, it may be advisable to allow the suckers to grow temporarily, as their growth will tend to absorb plant food and prevent second growth of the plants, which causes the leaf to turn a very dark colour and renders curing extremely difficult.

Seed Selection.—The selection of suitable seed plants commences when the crop is about half grown; any particularly promising plants should be marked and kept under observation. In the event of the early appearances being deceptive and the development being undesirable, the plant should be topped. Diseased plants must be discarded. Systematic elimination of inferior seed plants and the use of seed produced only by plants conforming to a high standard is essential, not only for the welfare of the individual grower, but also for the progress of the tobacco industry as a whole.

Harvesting.—The tobacco should be harvested when it is ripened to the correct degree required for the method by which it is to be cured. Flue-cured and fire-cured leaf should be fully ripe, whilst air-cured and sun-cured tobacco should be almost fully ripe when harvested. There are two methods employed in harvesting, viz., either by cutting the whole plant or by the removal of individual leaves.

The former system is largely employed in the dark fire-cured tobacco areas and the latter method is in general use throughout the bright flue-cured tobacco sections in Southern Rhodesia.

When harvesting by the whole plant method, the stalk should be slit down the centre to within 6 inches of the ground; then, after holding the plant slightly down and away from the operator, a slanting cut at ground level severs the stalk from the root. The plants are then placed astride the curing sticks; one such stick will hold from 6 to 10 plants, depending upon the size of the plants. The tobacco should be carefully handled in order to prevent unnecessary

damage, and the sticks should not be overcrowded with plants.

When the single leaf method of harvesting is employed, care should be taken to pick leaf of uniform ripeness; mixed picking increases the difficulty of curing the leaf satisfactorily in the barn.

When harvested before the proper time, the leaf will retain a green colour when cured, and if picked after the proper time, the colour will be uneven and blotchy, besides causing the texture to be harsh and lacking in quality. Leaf which cures out a deep green colour is of no commercial value. If the leaf is carefully handled during the harvesting and tying operations, much damage and bruising will be obviated. The tobacco should not be overcrowded on the sticks, nor should the barns be overfilled.

Curing.—The fundamental principle in the curing of tobacco is the gradual elimination of the water contained in the leaf. In the curing process this moisture is gradually expelled from the tissue of the leaf, and certain chemical and physiological changes take place which bring about the formation of those desirable qualities required in properly cured tobacco. If the rate of curing be carried on too fast, the colour of the leaf will remain green, and if too slow, the leaf will turn a dark brown or black colour. The curing should, therefore, be so regulated that the tobacco will dry out a desirable and uniform colour. Heavy bodied leaf will be longer in curing than light bodied leaf, and leaf which is yellow when picked will cure faster than green coloured leaf. Owing to the variability of numerous factors which influence the curing process, no set formula can be given for the curing of each of the various types of tobacco. A great degree of judgment and experience is required, otherwise irreparable damage may result.

The foregoing notes are intended to deal with the cultural and curing operations in a general sense only; specific information should therefore be sought in the articles on tobacco which have previously been published in the *Rhodesia Agricultural Journal* and are also available in bulletin form.*

* Bulletin No. 679, "The Harvesting and Curing of Virginia Tobacco"; Bulletin No. 715, "Turkish Tobacco Culture in Southern Rhodesia"; Bulletin No. 734, "Common Faults in Curing Virginia Bright Tobacco"; Bulletin No. 774, "Dark Fire-cured Tobacco—Harvesting and Curing."

Mycological Notes.

SEASONAL NOTES ON TOBACCO DISEASES, 2.—MOSAIC.

By J. C. F. HOPKINS, B.Sc. (Lond.) A.I.C.T.A., Government Plant Pathologist.

It is gratifying to note that during the last season tobacco growers were paying more attention to the question of the control of Mosaic disease in their crops. The necessity for producing good quality leaf in order to compete in the world's markets has induced a closer study of the factors responsible for deterioration in grade, which, in its turn, has revealed the part played by Mosaic in bringing about this deterioration. Two years ago, an article appeared in this Journal (1) calling the attention of farmers to the various manifestations of this disease in the crop, and it will not be out of place at this time of year to re-capitulate the most important points then raised. They are more fully discussed in the handbook of tobacco diseases (2) recently issued by this Department of Agriculture and obtainable from the Rhodesian Printing and Publishing Co., Salisbury (4s.).

For the purposes of clarity, the several kinds of Mosaic which are known to be present in the Colony will be treated as a whole, because, being due to either one or several infectious viruses, their etiology and control measures are presumably identical as far as is at present known.

Ordinary tobacco Mosaic is well known to all growers and is characterised by a light and dark green mottling of the leaf in normal circumstances, but is also frequently the cause of "blistering" and other malformation. The

various forms which Mosaic may take appear to depend to a large extent on environmental conditions, and include stunted growth and consequent reduction in yield, the production of narrow leaves lacking in "body," many of which cure out in the short grades, or spotting and "scorching," which may develop to such an extent as to make the leaf quite valueless.

A common type of Mosaic spot usually first becomes visible as a small circular brown lesion which gradually enlarges until it attains a diameter of about one-eighth of an inch. The spots rarely exceed this size, but may be very numerous and coalesce to form light brown blotches, in which the outlines of the original spots can be discerned. Usually a faint zonation may be observed in the individual spots, but there is never to be seen any yellow margin or "halo" such as is associated with bacterial diseases. Under certain conditions leaves showing this type of spotting may not exhibit any marked mottling, and it would be difficult for the average farmer to recognise the presence of Mosaic; but if the plant is growing normally, the leaf mottling is always a prominent feature of the disease. What is generally known as "sun scorch" can be seen on most tobacco farms at some time during the season and may cause quite considerable losses. It is also well known in the Union of South Africa, having been described by Moore (3) in 1927. Minute brown spots first appear on the leaf between the veins, and increase in numbers to such an extent as to produce "rusted" or "scorched" areas half an inch or more across. These brown patches enlarge and run together until nearly the whole of the leaf surface may become a mass of torn shreds of dead tissue. Frequently Mosaic mottling is entirely absent on "scorched" leaves, but it is usually present in leaves higher up the stem, and the connection between the two symptoms is easily established.

A third type of spotting is frequently found on heavy tobacco, such as the Western variety, and if the leaves are very dark green in colour, such as happens after the plants have been topped, the spotting appears to be unaccompanied by mottling. Less mature plants, however, usually show faint Mosaic markings, at any rate in the top leaves, but the spotting is the most pronounced symptom. Very small

white spots, which develop as a rule in the dark green Mosaic areas, are first observed. They are usually bounded by a narrow brown margin, and as they increase in size they run together to form larger dead areas of a light brown colour, which contain the numerous, approximately circular, white spots placed close together. It has been found that certain fungi are often associated with the white spotting, and if weather conditions are favourable a considerable extension of the diseased area may be brought about by the growth of these organisms. In extreme instances the leaf may be rendered quite valueless after curing, during which process the spotting appears to be accentuated. It will be seen, therefore, that Mosaic may reduce the value of a tobacco crop in several different ways, and it would be well for all growers to realise that the disease does not manifest itself solely as a mottling of the foliage. Work in America has shown that similar conditions exist there with regard to leaf spotting, and an analysis of the effect of Mosaic upon yield and quality of three successive crops has given most interesting results (4). It has been shown that a reduction in yield of 30 to 35 per cent. resulted from plants which became infected at transplanting time, and that the damage was almost as severe when infection took place one month later (approximately at the time of our first priming). More startling still is the figure for loss in gross total value of the crop, which amounted to as much as 55 per cent. The average value per acre of the crop which was infected at planting-out time was 103.56 dollars, as compared with 249.12 dollars for clean leaf. The reasons for this depreciation in value were the same as encountered in Rhodesia, namely, "shorts," thin texture, spotting and discoloration. It is hoped that this warning of the dangers of Mosaic will serve to bring about a definite resolve on the part of tobacco growers to eliminate the disease, which otherwise may become more widespread each year.

Control.—The problem of how Mosaic is carried from season to season has not been fully solved, but certain facts are known which indicate the presence of other host plants in the cycle of infection. It has been shown that the virus of tobacco Mosaic can be transmitted to a number of other plants of the same family (*Solanaceæ*), and it is known that

the peach aphis or green fly is an agent by which this transmission can be brought about. Consequently, when weeds, such as Cape gooseberry, and cultivated plants, such as potato and tomato, are constantly present in the fields throughout the winter months, and when it is realised that the majority of these weeds and many of the cultivated crops are found to be infected with Mosaic and more or less heavily infested with aphis, it is not a matter for wonder that the tobacco crop becomes infected in its turn, unless due precautions are taken.

In view of these facts, every effort should be made to eradicate weeds of the tobacco family from the farm, particularly the seed-bed site, and all tobacco stalks should be removed as soon as possible after reaping and not left standing till the following season.

With regard to the seed-beds, the measures which have previously been recommended for the control of Mosaic are based upon thoroughly practical considerations, and have been found to be successful by those farmers who have carried them out efficiently. It must be remembered that Mosaic of tobacco is one of the most highly infectious of plant virus diseases, so that the presence of a single Mosaic plant is a menace to the crop. It may frequently be found in the seed-beds, to which it may be brought in a variety of ways, but observations indicate that refuse from infected plants of the previous season probably supplies the chief source of infection. It will be asked how this refuse reaches the seed-beds, and the answer will in most cases be, "As boys' snuff." It is well known that the natives make their snuff and *nyoka* tobacco from the suckers of plants which are not uprooted after reaping, and the fact is equally well known that almost every plant in an abandoned field is infected by Mosaic. It has been shown conclusively (5) that dried tobacco leaf can remain infectious for years, so that there is every reason to believe that much Mosaic in seedling plants is introduced by the "boys" when working on the seed-beds. From the seed-beds these plants are transferred to the lands, and spread infection to a number of other plants with which they come in contact during the process. It is therefore necessary to remove all Mosaic plants from seed-beds as soon as they are discovered, and at the same time to remove a margin of

apparently healthy plants which may have contracted the disease. It has been shown on local farms that providing tins of disinfectant solution in which the labourers must wash their hands before commencing work on the seed-beds helps considerably in preventing Mosaic infection.

Soon after transplanting, when the first few leaves grow out, an inspection should be made of the lands, and, provided the number is not excessive, any plants showing Mosaic symptoms should be uprooted, removed from the land, and the hole refilled by a healthy plant. A second inspection should be made a little later and the process of eradication repeated. In this way few, if any, infected plants should remain in the lands, but if discovered, some effort should be made to prevent the infection being carried to healthy plants when the "boys" are priming. Some farmers are quite successful in putting on separate gangs to prime healthy and diseased plants.

When the crop is more mature, little or nothing can be done to reduce the damage resulting from the disease, so that the need for drastic action at the beginning of the season is most urgent. The early removal of tobacco stalks is also to be commended, and the wise farmer will endeavour, as far as possible, to prevent his "boys" from smoking or using snuff whilst working on seed-beds.

Removing infected plants as soon as they are found has given the best results locally in controlling Mosaic, whilst the provision of tins of disinfectant on the lands so that the "boys" can wash their hands at the completion of each row of "priming" or "suckering," undoubtedly puts a check upon the spread of the disease in the standing crop.

SUMMARY.

1. Mosaic disease causes a very substantial depreciation in the value of cured leaf, owing to the abundance of "shorts," poorness of texture, spotting and discoloration.

2. It is found in the seed-beds and probably introduced by the natives' snuff or *nyoka* tobacco.

3. Control depends on drastic action early in the season, constant elimination of diseased plants being the best method to be adopted.

REFERENCES.

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Witch Weed.

PROGRESS REPORT AND A WARNING.

By S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

This parasite still presents the most serious problem facing the majority of maize growers in the maize belt today, excepting, of course, the severe and world-wide depression, which intensifies the difficulties confronting the farmer who is fighting to destroy the pest, since, although we already know of a number of efficient methods of controlling witch weed, these all necessarily cost money, and the prevailing low prices of maize make rigid economy in every stage of the production of the crop imperative.

Nevertheless, the writer feels it is his duty to warn the maize farmers of this Colony, with all the emphasis he can command, of the inevitable result of neglect to control this most serious threat to the maize-growing industry. If the parasite is allowed to spread unchecked during this period of depression, it is certain that within a year or two many thousands of acres of the best soil in the Colony will become so seriously infested that no longer will it be possible to produce a crop of maize thereon at a profit, even though the export price rises to the former level of 10s. to 11s. per bag, until a great deal of money and labour shall have been expended on proper control measures.

Although a number of farmers are now fully alive to the seriousness of the situation, there are many more who are not, and the above remarks are addressed chiefly to the latter. The following statistics give some idea of the extent to which the pest has obtained a hold on the cultivated land of the

Colony, but it must be borne in mind that there are still a number of farmers who are unable to recognise the parasite, and it is, therefore, probable that the total acreage infested is considerably larger than these figures indicate:—

Acreage of Cultivated Land Reported to be Infested with Witch Weed, Year 1929-30.

Slightly infested.	Moderately infested.	Severely infested.	Total acreage infested.
26,113 acres	12,230 acres	34,382 acres	72,725 acres

One helpful feature of the present situation is that there is ample labour available throughout the Colony to-day, and the cost of it has materially fallen, and thorough and regular hand cultivation remains one of the best methods for controlling the pest whilst the degree of infestation is still moderate.

Trap-Cropping Trials: Value of Sudan Grass as a Green Manure.—However, when the land is seriously infested, other means of control, such as trap-cropping, become necessary. The results obtained during the last two years in experiments investigating this method, which have been carried out on farms in the Mazoe Valley and at the Agricultural Experiment Station, Salisbury, are very encouraging.

At the latter centre an experiment has been in progress, designed to investigate the value for green-manuring, of two crops of Sudan grass ploughed under during the same season, as is recommended for trap-cropping witch weed. The value of two crops of Sudan grass, each of six to eight weeks' growth, was compared with one crop of both the tall and the short strains of sunn hemp, and also with sunflowers (broadcasted thickly) as green manures for a following maize crop. These crops were grown on quadruplicated plots during the season 1929-30, and the maize was grown over the whole area in the season 1930-31. It should be mentioned that the first crop of Sudan grass was damaged considerably by army worm, and the second crop made poor growth owing to severe drought after sowing. Both strains of sunn hemp and the sunflowers made good growth.

The results are given below. The yields per acre are given in bags of maize of 200 lbs. each, and are the average yields of four plots each 1-24th acre in size:—

Crops ploughed under in 1930.	Mean yields per acre of following maize crop.
Two successive crops of Sudan grass in the same season—each 6-8 weeks old	16.74
One mature crop of sunn hemp (short variety)	16.26
One mature crop of sunn hemp (tall variety)	16.11
One mature crop of sunflowers	15.84

The experiment was laid down in the form of a Latin square and statistical analysis of the results in accordance with Fisher's methods shows that the standard error is 0.75 bag per acre. A difference in yield of 0.75 x 3, or 2.25 bags per acre, between any two of the mean yields of maize given in the above table is necessary to establish significance.

There is no significant difference between the yields of maize following Sudan grass and the other three green manure crops. In other words, two crops of Sudan grass have given results equal to sunn hemp and sunflowers as a green manure preceding maize. In passing, it is interesting to note that no difference in green-manuring value is shown between the short and the tall varieties of sunn hemp.

This result is of great importance, since it indicates that the farmer who is compelled to resort to trap-cropping to control witch weed can rest assured that he can safely substitute Sudan grass for the normal green manure crop in his rotation, and suffer no loss of yield from the following maize crop; at the same time the two crops of Sudan will reduce the witch weed infestation of his soil by approximately 75 per cent., as has been indicated by Saunders' work at Potchefstroom.

Uses for the Sudan Trap Crop other than as Green Manure.—There is no doubt that the ploughing under of the first Sudan crop in January may present considerable difficulty on the heavier soils and in some seasons, and the turning of it into hay may be impossible owing to wet weather. It may, however, be mown and made into palatable and nutritious silage for feeding to stock during the winter. The ploughing of the stubble should then present little or no difficulty. The second crop of Sudan grass may also be converted into silage or made into hay, since it will be ready to cut or plough under towards the end of the rains.

Use of mixed Sowings of Sudan Grass and Sunn Hemp.—A mixture of Sudan grass and sunn hemp was sown on witch weed infested land on Ledbury, Bindura, 20 lbs. per acre of seed of each being sown. It was found that the sunn hemp outgrew and overshadowed the Sudan grass, and for this reason this system of mixed trap-cropping is not recommended for general use. It is probable, however, that on soil in better heart and having a better supply of available nitrogen, the Sudan grass might hold its own with the sunn hemp, but since Sudan grass itself has been shown to give such excellent results as a green manure preceding maize and since the first object aimed at is the destruction of witch weed, it is thought that it is better practice to sow Sudan grass as a pure stand, and, if it is desired, it can be followed in the same season by sunn hemp alone ploughed under as a green manure.

A further objection to the use of mixed sowings of sunn hemp and Sudan grass is that the work of sowing must be done twice, as the seed of the two crops does not mix satisfactorily, and a patchy stand results from attempts to sow both in in one operation.

Trial of Local Kaffir Corns as a Trap Crop.—There is need for a trap crop as efficient as Sudan grass in germinating witch weed, and of which the seed is cheaper, or more easily grown on the farm. Saunders has shown at Potchefstroom that certain varieties of Kaffir corn are very effective trap crops, whilst others are more or less resistant to parasitisation by the weed. Three of the local Kaffir corns were tested in the field during the past season on

Craigengower Farm, Glendale, with a view to investigating their effectiveness as traps. One red variety and two white varieties were grown, each on duplicate plots, on severely infested land. The red variety was found to be a poor host of the parasite, but the two white varieties proved to be excellent hosts compared with maize or the red variety of Kaffir corn, and it would appear likely that these two varieties will prove valuable as trap crops, though further investigation on this point requires to be carried out. Both give good returns of grain, but are very susceptible to attack by birds. These varieties will be included in the green-manuring trial with Sudan grass and sunn hemp, already mentioned above as being in progress on the Agricultural Experiment Station, Salisbury.

Successful Trap-Cropping.—In one trial on Somerset Farm, Concession (A. S. Laurie), on soil generally infested with witch weed, two successive trap crops of Sudan grass, seeded at the rate of 20 lbs. of seed per acre, were ploughed under, after six weeks' and two months' growth respectively, during the season 1929-30. During 1930-31 a commercial crop of maize was planted, and it was found that a very striking reduction in the amount of witch weed was observable. A very few isolated plants appeared on the plot, whilst a heavy general infestation was observed on the control plots adjoining it, and particularly along the boundaries between the plots. The maize on the Sudan-trapped plot grew much more vigorously than the maize on the control plots, and gave a much higher yield of grain. It was particularly noteworthy that the maize on the former plot withstood the effect of the severe droughts in January and February very much better than the maize on the control plots, owing, without doubt, to the humus supplied by the two Sudan crops ploughed under.

Ploughing under Cowpeas in Two Successive Years.—A prominent Union farmer having stated that the ploughing under of a crop of cowpeas in two successive seasons had eradicated witch weed on some of his fields, this treatment was carried out on Craigengower Farm, Glendale (Mr. A. G. McCall), during the three seasons 1928 to 1930-31. In 1930-31 maize was planted on this plot and was still found to

be moderately infested with witch weed. There was no noticeable reduction in the amount of witch weed appearing above ground, but the maize throve despite the presence of the parasite.

On a two-acre plot on Ledbury, Bindura (Mr. A. Waddell), which was rather severely infested with witch weed, two consecutive crops of cowpeas were ploughed under during the season 1929-30, and maize was planted in 1930-31. The maize was severely infested with witch weed, but nevertheless made vigorous growth and gave an excellent yield of maize owing to the effect of the green-manuring.

This suggested method of eradicating witch weed has therefore proved quite unsuccessful, and cannot be recommended.

Growing a Catch Crop after Ploughing in a Trap Crop.— On the farms Somerset at Concession, Craigengower at Glendale and Ledbury at Bindura, the possibility of growing a catch crop in the same season following an early trap crop of maize or Sudan grass, has been investigated during the past three years. The results obtained indicate that, provided the trap crop can be planted sufficiently early to allow it to be ploughed under in late December or early January, successful crops of ground nuts, sunflowers for grain or silage, and cowpeas or Kaffir beans for seed or hay, can be grown successfully. Kaffir beans have given particularly good results, and excellent crops have been obtained even when planted as late as the end of January and in the beginning of February. Yields of 12 to 13 bags per acre of ground nuts have been obtained, after a trap crop of broadcasted maize ploughed under at the end of December. Maize planted with a view to cutting it for silage has not grown well after trap crops of maize or Sudan grass ploughed under. It is probable that the above crops will always grow better after Sudan grass than after maize, since the former crop rots more rapidly in the ground, when six weeks to two months old.

Other catch crops which might possibly be grown successfully after a trap crop are tepary beans, haricot beans, buckwheat and oats. They have not, at present, been tested for this purpose.

Smothering of Witch Weed.—It was suggested that it might be possible to control witch weed by smothering it, viz., by thickly planting such crops as Kaffir beans or cow-peas, sunn hemp, soya beans, pumpkins, etc., under the maize crop. A number of experiments on these lines have been carried out on the three farms mentioned above, during the past three years, but no success has been obtained, as it was found that witch weed flowered and seeded down under the thickest cover of these crops. It was even found to thrive under a very thick mixed growth of sunn hemp and Sudan grass. Attempts were also made to germinate witch weed and subsequently smother it by sowing Sudan grass in between rows of sunflowers. This system failed in its purpose, as it was found that the Sudan grass made practically no growth under such conditions.

Growth of Witch Weed after the Removal of the Host.—Some farmers are under the impression that if they remove the host, by cutting down the maize for instance, the witch weed growing on the host will be killed. This is not so, since witch weed can exist on its own root system, and grow, flower and set seed once it is above the ground.

In pot experiments, carried out in 1930-31, the host plant (maize) was removed by cutting it just above the ground level, when witch weed plants were growing in all stages, from $\frac{1}{8}$ inch high up to full flower, on its roots. All these plants grew normally, except for their being somewhat stunted, and flowered and set seed, including even those small plants which were only just above ground when the host was removed. It was even found that young witch weed plants were still appearing above ground *one month after the removal of the host.*

A crop of witch weed already above ground cannot, therefore, be destroyed by cutting off the host crop as when reaping it for silage; it is necessary also to plough the ground and bury the witch weed to kill it before it has an opportunity to seed.

Rapoko as a Host.—One or two farmers have suggested the use of the native crop rapoko or finger millet as a trap crop. Pot experiments have indicated that this crop is not a good host of the parasite, and it appears, in fact, to be

very resistant though not entirely immune to witch weed. This requires further confirmation, but it would certainly appear that rapoko would be useless as a trap crop.

Spraying of Witch Weed.—During the past season (1930-31) the usefulness of spraying with solutions of various substances as a method of destruction of witch weed was tested on Craigengower, Glendale, in co-operation with Mr. McCall, the owner of the farm.

The following materials were employed for the first spraying in a solution of 5 per cent. strength: (1) sodium chlorate, (2) atlacide calcium chlorate, (3) potassium chlorate, (4) copper sulphate, (5) Raphanit (a German preparation for the destruction of charlock in cereal crops). At the above strength all these materials gave a 100 per cent. kill in seven to ten days and *no re-growth of treated witch weed plants from the underground parts of the plants was observed.* There was never any doubt in the writer's mind that these materials would kill the aerial parts of the parasite when used in sufficiently strong solutions, but the fact that no re-growth of the treated plants was observed, was unexpectedly encouraging, and further trials were carried out with 2 per cent. solutions of copper sulphate and sodium chlorate, the other materials being abandoned on the score of their much higher cost.

The 2 per cent. solution of sodium chlorate again gave a 100 per cent. kill, but the copper sulphate did not kill satisfactorily at this strength. No re-growth of the treated witch weed was observed. These trials were carried out on duplicate plots. The weather during the trials was bright and cloudless at the time of spraying and for several days after. The witch weed plants were sprayed, as far as possible, so that all the foliage was wetted without any appreciable excess of solution running off to the ground. The spraying outfit was of the self-filling, pneumatic, knapsack type with a hand trigger control. A trigger control is considered essential for this work to avoid waste of material. At the same time, experiments with (a) sodium chlorate, (b) copper sulphate, (c) Raphanit, were carried out by the writer at the Agricultural Experiment Station, Salisbury. Solutions of 2 per cent., 3 per cent., and 4 per cent. strength were em-

ployed, the trials being made in triplicate with the 2 per cent. strength, and in duplicate with the 3 per cent. and 4 per cent. solutions. The 2 per cent. sodium chlorate gave a complete kill in seven days; whereas the same strength solution of copper sulphate and Raphanit killed only 23 per cent. and 11 per cent. respectively, and after ten days the remainder of the plants recovered. *None of the plants which were killed made re-growth from below the ground.*

In a further trial, 1 per cent. and 2 per cent. solutions of sodium chlorate and a 4 per cent. solution of copper sulphate were tested out on a small scale, and the solutions of sodium chlorate gave a complete kill of all plants in eight and five days respectively. The 4 per cent. copper sulphate gave only a 16 per cent. kill and the remaining plants recovered. The control plants all remained healthy.

The results of these later trials with 1 per cent. and 2 per cent. solutions require confirmation during the coming season, since they were carried out late in the year (late March and April), and it is possible that the more robustly growing parasites appearing in February and early March, when the host crop is still growing vigorously, may not be killed by such weak solutions.

Conclusions.—The above results are sufficiently encouraging to cause one to believe that it is probable that the spraying of witch weed with sodium chlorate may be an economic and useful method of control, provided the difficulty of the water supply is overcome. In this connection, it may be mentioned that Mr. McCall is already convinced of its possibilities and proposes to spray a considerable acreage during the coming season, and will keep an account of the costs of labour and materials for the benefit of other farmers. No damage to the maize crop was noticeable during the trials on Craigengower, but accurate replicated experiments are required to investigate this point in a proper manner.

When the first spraying becomes due, that is, when the first witch weed plants come into flower, it will usually be found necessary to carry out a hand cultivation of the land to remove the crop of late weeds and grass which grows up under the maize, since these interfere with the spraying.

If this is necessary, it is best to cut off the witch weed at the same time. The witch weed can then be sprayed when it next begins to come into flower. This was done in the trials referred to on Craigengower.

It should perhaps be mentioned here that, although the use of some of the above materials in the form of a dust is possible and would avoid the difficulty of water supply, it has been found in New Zealand during trials on the destruction of other weeds, that this increases the cost per acre of materials too much, and it is considered by the writer that such would certainly be the case here when treating witch weed. Further, much more of the material would reach the soil and adhere to the maize plant, and the poisonous effect on the maize might thereby become marked.

Warning.—Should any farmers decide to carry out trials with sodium chlorate for killing witch weed, they are warned that the clothes of operators doing the spraying, which become wet with the solution, should later be well rinsed in water, since the sodium chlorate causes such materials to become dangerously inflammable when dry.

Check-row Planting of Maize by Machine.—The writer has pointed out in a previous article published in the issue of this Journal for January, 1931 (re-published as Bulletin No. 802), that check-row planting of maize by machine on witch weed infested land, helps very materially to reduce the cost of cultivation to control the parasite, by making it possible to cultivate both ways with single-ox cultivators, thereby greatly reducing the hand labour necessary.

It is desired again to bring this point to the notice of all farmers concerned and to emphasise it. The writer is aware that many of the older farmers in the Colony are prejudiced against the use of the check-row planter owing to unfortunate experiences with older models in the past, but experience over the past three seasons proves conclusively that the modern check-row planter is just as reliable as the ordinary planter and presents no difficulties in the hands of the average native driver, and will cover almost as large an acreage in the day. On the Government farm, Gwebi, as much as 10 acres in a day have been planted without difficulty, and a number of private owners are enthusiastic

about the performance of their machines and the resulting stands of maize. The farmer who is not worried by witch weed is also strongly advised to give this planter a trial, as he can thereby ensure a perfect stand of plants, and so increase his yield per acre very materially. It is not necessary to purchase the complete planter, since check-row planting attachments can be purchased separately to fit existing planters of all the well-known makes, at a cost of about £5 each.

Experiments Still in Progress.—A number of field trials and experiments not mentioned above are still incomplete. Others are complete, but showed indecisive results last season, due, it is thought, to the abnormally short growing period of the witch weed owing to the early cessation of the rains. As evidence in support of this opinion, it may be mentioned that during the period 11th June to 13th June in both the years 1930 and 1931, the writer toured the Mazoe Valley from Concession to Shamva. In 1930, at this period, witch weed was seen to be still in full, vigorous growth in all stages of development, whereas during the same period in 1931, not a single live plant of witch weed was to be seen; it had all withered and died off, presumably owing to the early ripening of the maize and the extreme dryness of the soil. This was undoubtedly chiefly due to the latter cause, since, as already shown, once the parasite is above ground, it will continue to grow and thrive despite the death of the host, providing there is sufficient moisture in the land. In this connection, it may be of interest to mention that in the pot experiments referred to above, several witch weed plants were still alive and flowering in September, 1931, although the hosts had died off in April; the pots having in the meanwhile received water regularly.

Curing Tobacco by the Leaf Method v. Curing on the Stalk.

By W. Collingwood-Evans, B.Sc. (Agr.).

(This paper embodies the substance of a lecture given by Mr. W. Collingwood-Evans, and is published at the request of the Shamva tobacco growers.—Ed.)

There are many problems in this country which can be solved only by individual experimentation. We may, however, be saved considerable pointless experimentation by going through the scientific work completed in other countries. Before drawing conclusive inferences from foreign results though, it is essential that there be a basic similarity in the points to be compared. The subject in hand is one which has occasioned considerable discussion in many tobacco growing areas of the world, and it is only in recent years that conclusive and authoritative work has been completed on the subject.

In view of the previous statement regarding foreign experimental results as applied to this country, it may appear paradoxical to cite American and German data in support of my contentions. My reason for doing so is that curing quite definitely involves a succession of physiological processes. The fundamental laws governing plant physiology remain more or less constant, whether they be operating in Germany, America or in this country. There may, of course, be differences in the rate of the sap flow, and a consequent increase in transpiration, due to climatic conditions. There may, too, be some difference in the metabolic processes in the leaf. Whatever differences there may be, however, I think we may definitely say that they are brought about by the laws of plant physiology as we know them.

Considering the important rôle that curing plays in this industry, it is indeed remarkable to note how very little scientific attention it has received. The methods in vogue at the moment are more or less governed by set rule, and except in those times where it is blatantly obvious, insufficient allowance is made for the prevailing weather conditions.

It will not be necessary to give any detailed explanation of the two methods of harvesting, for doubtless these are well known. In the one instance the individual leaf is picked; in the other, the leaves are not removed from the stalks, but these are cut off near the ground and suspended in an inverted manner in the barn. It is important to note, however, that before cutting the stalk at the base, it is split longitudinally and then placed astride the stick.

Curing, it is very evident, is a maturing process in a still living leaf. Growers know that a leaf which has been bruised or in any way damaged in the field will not cure normally.

It is well to understand and know the limits of curing, and what it does to the leaf. Curing changes the chemical and physical properties of the leaf with particular respect to such qualities as the capacity to hold fire, colour, texture and the elasticity. It is quite wrong, however, to assume that curing improves or develops the aroma. When curing has been properly performed, the latent possibilities for developing the aroma are preserved. Subsequent fermentation improves some of the above-mentioned leaf properties still further, but faulty curing cannot be corrected by subsequent fermentation, as several of the curing processes are not continued in the fermentation.

Curing involves mainly two familiar physiological processes:—

1. Respiration.

2. Translocation of the mobile nutrients.

The leaves and the stalk, or the leaves alone, as the case may be, are deprived of a water supply from the root system, and also, to a large extent, of sunlight. *Respiration*, however, continues, and the leaves are thus subjected to a process of starvation; the rate of the starving is largely dependent upon the rate of drying. It is interesting to note

at this juncture that the changes in composition during curing (due to respiration) are almost identical with the changes under normal respiratory conditions. Temperature and humidity play a very important rôle in the process, and upon suitable regulation of these, the success or failure of curing depends.

The other important phenomenon, *translocation*, involves the movement of soluble nutrients from the leaf web into the veins, from here into the mid-rib and thence into the stalk. The popular conception is that the reverse of this takes place, and, indeed, the importance of translocation when the leaf was being cured on the stalk was overlooked for a time by very competent investigators. When a plant is pursuing its normal growth in the field, there is a movement of the products of photosynthesis (plant foods) rendered soluble by enzymes, where necessary, from *the more mature leaf*, to the *younger growing parts*. Essentially the same thing takes place during curing, though when superficially considered it may appear to be the reverse. All surplus food is stored within the leaf web; this dies first. The veins remain alive a little longer, and the mid-rib is the last to die. If the stalk is attached, it may remain alive for several weeks after the drying out of the mid-rib. Every person that has used the stalk method of curing will have noticed the development of suckers in the leaf axles. The food necessary for the maintenance of these suckers has been taken from the leaf surplus. I think all farmers are familiar with "pole sweat," and know that it is caused by excessive moisture. The excessive moisture caused the dying cells to retain a great deal of water, thus facilitating the more complete translocation of nutrients into the stalk. Oft-times this results in a congestion of the conductive tracts leading into the stalk. The result is that an abscess is formed at the juncture of the mid-rib and the stalk, causing it to fall off.

Investigators at one time maintained that the leaf weighed more when cured on the stalk, because of a movement of nutrients from the stalk into the leaf. Others again maintained that there was no particular difference either in weight or quality of the ultimate product. W. W. Garner, of the United States Bureau of Plant Industry, and E. C. J. Mohr, the German physiologist, were the first to give us

very definite and satisfactory information on the point. Mohr, in particular, brought out the errors in previous procedure, and also pointed out very clearly the misinterpretation of results by these previous investigators. The type of tobacco he worked with was a fire-cured tobacco. The type of tobacco is not highly important however, for, following the technique as laid down by Mohr, the same results have been obtained by others, when working with flue-cured tobacco.

Mohr found that leaf cured on the stalk loses in weight approximately 11 or 12 per cent. more than if cured after being picked from the stalk. To put it another way, we may say that a picked leaf after curing will weigh 11 or 12 per cent. more than the same leaf if cured on the stalk.

By a study of the analyses, it is easy to perceive that the increased loss in weight when cured on the stalk is due not so much to intense respiration, but rather to a translocation of nutrients from the leaf into the stalk.

TABLE I.—LEAVES CURED BY PRIMING METHOD.

Tobacco Leaves	A. 1926			B. 1927			C. 1928		
	Leaf Web	Stems	Whole Leaf	Leaf Web	Stems	Whole Leaf	Leaf Web	Stems	Whole Leaf
Weight of 100 dry leaves—									
Uncured ... ... gms.	409.5	155.1	564.6	335.2	117.2	452.4	294.8	121.4	416.2
Cured ... ... gms.	329.4	157.5	486.9	306	98	404	256.4	98.6	355
Loss of weight in curing per cent.	19.6	1.6	13.8	8.7	16.4	10.9	13	18.8	14.7
Leaves—									
Uncured ... per cent.	72.5	27.5	100	74.1	25.9	100	70.8	29.2	100
Cured ... ... per cent.	67.6	33.4	100	75.7	24.3	100	72.2	27.8	100
Weight of pure ash in 100 leaves—									
Uncured ... ... gms.	44.9	26.9	71.9	51.2	26.7	77.9	38.4	23.3	61.7
Cured ... ... gms.	43.9	26.3	70.2	55.3	25.2	80.5	41.4	22.2	63.6
Gain or loss of ash in curing per cent.	−.24	− .38	−.29	−1.20	−1.28	−.57	−1.02	−.91	−.45
Loss of organic matter in curing ... ... per cent.	19.6	−1.6	13.8	9.6	14.3	10.9	13.6	17.3	14.7

Acknowledgment is made for the use of these tables to the U.S. Bureau of Plant Industry.

TABLE II.—LEAVES CURED ON THE STALK.

Tobacco Leaves	A. 1926			B. 1927			C. 1928		
	Leaf Web	Stems	Whole Leaf	Leaf Web	Stems	Whole Leaf	Leaf Web	Stems	Whole Leaf
Weight of 100 dry leaves—									
Uncured ... ... gms.	437.1	165.9	603	342.9	145.4	488.3	297.6	123.1	420.7
Cured ... ... gms.	312.4	134	446.4	238.1	104.6	342.7	230	86.7	316.7
Loss of weight in curing per cent.	28.6	19.2	26	30.6	28.1	29.8	22.7	29.6	24.7
Leaves—									
Uncured ... per cent.	72.5	27.5	100	70.2	29.8	100	70.7	29.3	100
Cured .. ... per cent.	70	30	100	69.5	30.5	100	72.6	27.4	100
Weight of pure ash in 100 leaves—									
Uncured ... ... gms.	45.3	24.8	73.7	42.3	27.9	70.1	38.6	23.2	61.9
Cured ... ... gms.	41.4	26.4	67.8	40.3	23.1	63.4	37.3	18.6	55.9
Loss of ash in curing per cent.	.89	1.20	.98	.59	3.31	1.38	.43	3.74	1.42
Loss of organic matter in curing ... ... per cent.	27.7	18	25	30	24.8	28.4	22.3	25.9	23 3

Acknowledgment is made for the use of these tables to the U.S. Bureau of Plant Industry.

The above tables show the loss in dry weight in the curing of heavy leaf; Table I cites the figures of the priming method and Table II of the curing on the stalk method. It will be seen that the losses in dry weight by curing the leaves on the stalk were 12.2, 18.9, and 10 per cent. respectively greater than the losses in curing the picked leaves. It must be understood that very exact analyses were carried out in all the work, Mohr's methods of procedure having been closely followed. It will be observed that in comparing the two sets of results for 1927, there is a larger indicated difference in loss of weight between the two methods, than in the two others of 1926 and 1928. This is almost entirely due to the extremely small loss of weight of the picked leaves which in turn is explained by the abnormally low content of starch in the picked leaves at the time of harvesting. If we take the average of the differences between the losses in weight for the three years, we find that it is 13.7 per cent. This result is close enough to Mohr's 12 per cent. to be taken as conclusive, the tobacco being of the same general type.

In working with the lighter types of leaf, similar analyses were performed and tabulated. It is not necessary to quote the results here, as all the lighter type of tobacco in this country is cured by the leaf method.

The differences of loss of nicotine, proteins, pentosanes, nitrogen, sugars and starches, have all been worked out in the process of obtaining the ultimate result. For practical purposes knowledge of the intervening and complicated details of the experiment are negligible.

In summing up the more important differences in the results of curing the leaves on the stalk as compared with curing the picked leaves, which are brought out in the experiments, it can be noted that the loss of weight in dry matter ranges roughly from 11 to 14 per cent. when the leaves are cured on the stalk. In stalk curing, in addition to the respiratory activities which constitute the important factor in curing the *picked leaves*, the translocation of mobile materials from the leaf into the stalk assumes a very important role. This translocation of materials from leaf to stalk constitutes the essential difference between this method of curing and that in use after the leaves have been removed from the stalk.

It is evident that the phenomena of translocation in the curing of tobacco leaves attached to the stalk follow essentially the same laws as obtain during the growth and development of the plants under the same conditions. Only constituents that are physiologically vital however, undergo this translocation to any marked and measurable degree.

In the leaf method only those leaves which are properly ripe need be reaped, and indeed only those that are ripe should be reaped. In the opposing method it frequently occurs that the one half of the plant must be sacrificed to the other half. That is, when the lower half is ready for reaping, the upper half is more or less green. This must very definitely prolong the curing, and also account for quite a fair amount of the green leaf in the cured crop.

Many farmers complain of a great deal of breaking and bruising when reaping and transporting the entire plant. This damaging of the leaf goes on despite thorough wilting. To a large extent this is obviated when reaping the single leaf, and although it is advisable to wilt the single leaves, the process does not take as long. It is the practice of some farmers to place the leaf under a low grass shelter placed near the reapers.

From a point of view of barn space, the leaf method is the more accommodating. When curing on the stalk, a space of four feet is necessary between each tier. For the leaf method, at least three feet is required, although it is a good practice to leave four feet if the barns have been constructed for the stalk method. Sticks hung with leaves on the stalk, should be spaced at least 12 inches apart. With the single leaf, however, 6 to 8 inches is ample.

The actual curing of the single leaf is I think, a little more difficult than curing on the stalk. By difficult I mean that the desired changes in the leaf are apt to come about more quickly. It is therefore necessary to keep a close watch. Also towards the end of the curing season when the atmosphere is apt to be dry, the stalk method renders itself easier by virtue of the moisture given out by the stalk. This difference in the ease of curing is purely a comparative one, and it is quite possible to cure on the leaf all through the season with as good results as are obtainable when curing on the stalk.

Tobacco Experiment Station, Salisbury.

REPORT OF GENERAL CROP EXPERIMENTS.
(Concluded.)

By C. A. Kelsey Harvey, Manager.

(Published with the Authority of Chief, Division of Plant Industry.)

Maize Following Tobacco on Ploughed versus Unploughed Land.—A number of tobacco growers have reported good results from planting maize on land which had carried tobacco the previous year, without first ploughing the land (the maize being planted in the same holes previously occupied by the tobacco plants), and experiments were conducted during 1928-30 to test the value of this practice.

The system adopted for the unploughed plots was to leave the ridges in the previous year's tobacco field as they were, the dead tobacco plants merely being uprooted and burnt in the winter. The seed maize was sown with the first planting rains in the depressions in the ridges left by the removal of the tobacco plants, the maize being thus automatically check-rowed. The land was then disc-harrowed and cross-harrowed until the crop was well established. On the control area, the plots also previously under tobacco were ploughed once in the usual way.

In both seasons the residue of the tobacco fertiliser concentrated in the holes where tobacco had grown enabled the maize on the unploughed plots to make rapid early growth; but excessive weed development was later encountered, and in both seasons it was necessary to cultivate

six times, including two hand hoeings, whereas four cultivations were necessary on the ploughed plots, only one of which was by hand.

The following table gives the average yield of maize from these trials during the two seasons:—

Year.	Soil.	Average yield in bags per acre.	Remarks.
1928-29	Red contact	16.27	Unploughed
		21.29	Ploughed
1929-30	Grey sand	9.14	Unploughed
		8.09	Ploughed

Rainfall for season 1928-29, 27.32 ins.; for 1929-30, 21.45 ins.

It would appear that on poor sand veld, under short rainfall conditions, there is little difference between the ploughed and unploughed land, although there is a marked increase in yield from the ploughed plots on contact soil when the rainfall approached normal. However, the excessive weed growth encountered on the unploughed land, necessitating, as it did, an average of six cultivations, will usually render this method of maize growing inadvisable on economic grounds.

Maize Following Tobacco, with and without Additional Fertiliser.—Very fair maize crops can generally be grown on sand veld after one or two successive tobacco crops. Maize followed tobacco in three of the rotational experiments on this station, and in rotation B the sequence of crops was—

1st year: Tobacco with 200 lbs. per acre double complete tobacco fertiliser (7.20.10);

2nd year: Tobacco with 150 lbs. per acre blood meal fertiliser (6.18.8);

3rd year: Maize.

The following table indicates the results of trials where (a) no additional fertiliser was given to the maize crop, and (b) where 150 lbs. per acre of bone and superphosphate was added for the maize crop.

The plots were all situated on poor, light sand, maize of the Salisbury White variety being check-rowed in the usual manner three feet by three feet apart:—

Average Maize Yields after Tobacco.

Year.	Rainfall, inches.	Yield in bags per acre.	Remarks.
1926-27	20.47	6¾	No additional fertiliser to maize.
1927-28	24.70	9½	No additional fertiliser to maize.
1928-29	27.32	16¾	150 lbs. per acre bone and superphosphate to maize.
1929-30	21.45	12¼	150 lbs. per acre bone and superphosphate to maize.

Maize with Phosphatic Fertiliser versus Farm Manure.—Six half-acre plots were under this experiment. The maize followed a maize crop underplanted with kaffir beans the previous year, the beans being ploughed in after the maize had been stooked. The crop was planted in 1929; seeding took place on the 27th November and four cultivations were given.

The farm manure plots received two *double* handfuls of dry, dusty manure to each hill, careful records being kept of the weight applied per acre. A little over three tons per acre was the average dressing given in this way.

Similar treatment was accorded to the same plots in 1930-31. The following table shows the average yield per acre over the two years, both of which were very unfavourable:—

Maize Yields in Bags per Acre.

Treatment.	Average yield over 2 years.
3 tons kraal manure per acre: applied in two double handfuls per hill before planting	10.05
150 lbs. per acre bone and superphosphate: broadcasted just prior to planting	8.60
Control plots: no manure or fertiliser	6.42

The system of applying two double handfuls of manure to each hill is an economy in the use of available manure, and although the dressing is fairly light, i.e., three tons per acre, there was a fair increase of the crop over the average

of the control and fertilised plots. Observations taken when the manure was being applied show that native labourers are prone to skimp the application of two double handfuls, and care needs to be taken to see that the full quantity is applied.

Maize Following a Green Manuring: With and Without Phosphatic Fertiliser.—In these trials the maize in both cases followed velvet beans ploughed under. One series of plots received a dressing of 150 lbs. per acre of No. 1 superphosphate (19.5 solubility), the fertiliser being applied by hand in the hills one month before the check-rowed maize was sown. The second series of plots received no fertiliser, but in all other respects were treated in the same way as the first series. The soil was typical grey granite sand.

Previous year's crop.	Fertiliser applied per acre.	Average yield in bags per acre.
Velvet beans ploughed under	150 lbs. No. 1 superphosphate	17.33
Do.	None	12.52

The same treatment was accorded to the same plots in 1930-31.

Yields in Season 1930-31.

Previous year's cropping.	Fertiliser.	Yield in bags per acre.	Average for 2 seasons.
Velvet beans ploughed under in 1928-29; maize, 1929-30	150 lbs. per acre No. 1 superphosphate in 1929-30 and 1930-31	11.10	14.21
Same as above	None	7.52	10.02

Top Dressing Maize with Nitrate of Soda.—A trial of this treatment was made in 1929-30, plots receiving 100 lbs. and 50 lbs. of nitrate of soda respectively six weeks after planting, while other plots serving as controls received no top dressing. A basic treatment of 150 lbs. per acre of bone and superphosphate was first applied. Comparatively little rain fell subsequent to the top dressing being applied, and the controls yielded better than the plots receiving 50 lbs. per acre of nitrate. The 100-lb. dressing, however, gave a slightly increased yield over the controls.

Scrap Tobacco as a Fertiliser for Maize.—Most tobacco growers every season accumulate scrap tobacco which is quite unsaleable, and experiments in utilising this waste product as a fertiliser for maize have been made.

The great danger to the tobacco grower in using unburnt scrap is the fear of spreading bacterial disease in subsequent tobacco crops or in tobacco adjacent to the maize field. In this trial it was therefore considered safest to burn the scrap and use the ash as a fertilising medium. Preliminary tests showed that the loss in weight of scrap tobacco when burnt was approximately 90 per cent., and analysis of the ash indicated its value to be about four-fifths of that of sulphate of potash, or about £12 per ton, based on the price of this commodity in Salisbury at the time the analysis was made.

From these figures it may be seen that a planter would require to burn about 100 bales (200 lbs. each) of scrap tobacco to obtain one ton of this fertiliser.

Three plots were put down to this experiment:—

Plot A received 600 lbs. of tobacco ash per acre.

Plot B received none.

Plot C received 800 lbs. of tobacco ash per acre.

The maize was planted by hand in check rows, the tobacco ash having been previously placed in each hill and hoed in. The soil was a light sandy one, which had carried two previous crops of tobacco both fertilised in the usual manner.

No increase in yield was obtained from the application of the ash, and, owing to the small amount obtainable, the system is hardly feasible in practice, while the use of unburnt scrap as a fertiliser where tobacco continues to be grown cannot be recommended for reasons stated above.

"SUBTERRANEAN CLOVER ON THE SAND VELD AS GREEN FEED FOR POULTRY IN THE WINTER."

(Correction.)

Page 1,025, line 29, of November Journal should read "4s. 4d. to 5s. 3d.," and not "17s. 6d. to 21s." as printed.

The Possibilities in Cultivated Pastures.

By A. E. Romyn, M.C., M.Sc.Agric., Ph.D.,
Senior Animal Husbandry Officer.

During the last few years there have been phenomenal improvements in the methods of grass land management. It has been said that the present age in agricultural history will be known as the "Grass Age."

Two factors more than others have influenced the world-wide tendency now in evidence to swing from arable to pastoral farming. These are the relatively high cost of agricultural labour, which is comparatively more important in the growing of crops than in raising of stock on pasture, and the overproduction of the chief cereal grains which has occurred in the last few years. Both these factors have heavily handicapped the maize farmer in Rhodesia, and the present seems an opportune time to speculate on the effects that the adoption of an improved pastoral system in Rhodesia would have on our cattle industry.

The cheapest method of producing animal products such as meat, milk, butter, cheese, etc., is "off grass." In other words, to make the maximum use of pasture with the minimum use of supplementary feeds.

At the present costs of production, maize and the common fodder crops are relatively expensive feeds. Their use in the production of meat and dairy products for export should be restricted to periods such as weaning and winter maintenance, and to the correction of deficiencies in the pasture where small amounts of feed produce important results. The advice to "market one's crops on the hoof" is sound, but it should be tempered by a reference to the

law of diminishing returns and the nature of the crop which is being marketed.

Two alternatives present themselves. Either the cost of production of our arable crops must be greatly reduced, or our pastures must be managed in such a way that we can compete successfully with other exporting countries in the southern hemisphere. The solution probably lies in the application of both methods. This article, however, is concerned mainly with the road through pastures.

During the last two years in the Union of South Africa increased interest has been shown in the subject of pastures. Propagandists are not lacking who claim that in the heavier rainfall areas it is possible to establish cultivated pastures equal to any in the world.

In a trial at Cedara, Fisher obtained, without the use of grain, 600 gallons of milk per annum off a fertilised paspalum pasture on poor hillside soil. Six hundred gallons of milk at 5d. per gallon, which includes the separated milk, are worth £12 10s. During the last grazing season the carrying capacity of an acre of Kikuyu pasture at the same station was two cows per acre for seven months of the year. Wall, near Maritzburg, claims a much heavier yield of 1,000 gallons of milk per acre per annum off similar pastures. The annual expenditure on fertiliser on these pastures is from £2 to £3. These results compare favourably with reported yields of 500 gallons of milk per annum on fertilised pastures in the West of England, and 170 lbs. of butter fat per acre on well-managed farms in New Zealand. Under present conditions to produce these results would probably take five to twenty acres of unimproved Rhodesia veld plus five to six bags of concentrates.

Under conditions of lighter rainfall near Pretoria very satisfactory results have been obtained from woolly finger grass and Rhodes grass. Unsupplemented by grain, both these grasses have been able to produce a gain of over 200 lbs. of beef per acre per annum from improved beef steers. These results compare well with yields of 200 to 300 lbs. of beef per acre on improved pastures in the Midlands and West of England. There is also the classic experiment of Pole Evans where a mature cow has been maintained for

five years on half an acre of woolly finger grass. Under irrigation twelve sheep were maintained for three years on half an acre of wild white clover and Fescue grass; and, while it may be doubted whether sheep would remain healthy under our conditions if grazed at such an intensity, the results undoubtedly show the very heavy carrying capacity of the pasture.

Experiments on a similar scale have not been carried out in Rhodesia. We have not the experience to say whether results similar to those in the Union would be obtained, say, on the Eastern Border, or on the arable soils of the Mazoe Valley. The work that has been carried out so far by Husband at the Pasture Research Station at Marandellas and at the Matopo School, and by Mundy at the Salisbury Station, gives promise, however, that cultivated pasture grasses and clovers may in the future play a much more important part in our system of stock farming than they have done hitherto.

It is worthy of mention also that, during the grazing season of 1930-31, woolly finger grass and Hunyani grass at the Salisbury Station furnished 250 and 292 grazing days for cattle respectively per acre. Though no weights were taken, it was estimated that one acre of each would have maintained one and a half to two cows for the period 15th December to 15th April.

No one policy can be applied to the country as a whole. Kikuyu and paspalum have done well on the Eastern Border, and it does not seem unreasonable to expect that similar results to those obtained in Natal could be obtained there. Whether Rhodes grass or woolly finger grass will give as good results on the red soils of this country as on the drier grassed areas in the Union has still to be determined on an economic scale. There may be indigenous grasses which will answer better. In this connection it is of interest to note that at the botanic station at Pretoria the Rhodesian Timothies and antelope grass gave results but little inferior to woolly finger grass. A local swamp couch grass and certain strains of clover obtained from Aberystwyth by Mundy have shown promise as permanent winter pastures on the sand-veld vlei soil of Mashonaland.

From these results it is easy to picture a profitable system of stock farming in Mashonaland based on the controlled grazing of the natural veld in the summer and the use of permanent vlei pastures in the winter, supplemented by veld hay cut at the proper stage or grass silage. Husband's success in duplicating the good results obtained elsewhere in the control of the natural grazing is of particular interest in this connection. The arable farmer in the Mazoe Valley may also well find that an acre of permanent pasture will give him more profit from live stock than two acres of crops grown for the same purpose.

Much has still to be done.

There is little doubt that a great improvement in the carrying capacity of the natural veld can be effected by proper camping and the improvement of the watering facilities. Information in regard to the optimum intensity and frequency of grazing is, however, lacking. This information would be of particular value in Matabeleland, where, under conditions of lighter rainfall, the grasses apparently suffer sooner from mismanagement than in Mashonaland. It is possible also that the slow growth of young stock under our conditions may be attributable in large part to mineral and protein deficiencies in the natural pasture. Some work which it is planned to commence at the Matopos this summer may throw light on this problem. Any practicable method of supplementary feeding which would make good the deficiencies in the natural grazing would be of great value, not only to the farmer on good pastures, but also to the rancher who is unable for economic reasons to improve his veld.

The breeds of cattle should be suited to the pasture, and the cattle should improve concurrently with the pastures. Where grazing conditions are good, the dairy breeds are likely to become established. On the less nutritious pastures, or veld, the beef breeds are likely to give the best returns in the long run. Large areas will, however, probably remain where it will not be an economic proposition at present to improve the natural pastures to the stage where they will properly maintain improved cattle of the beef breeds.

A sound breeding policy has as yet to be worked out for this last type of country. Three alternative breeding systems present themselves. Either "pure" Africanders may be raised; or a grade beef animal in which a certain proportion of Africander blood is maintained; or a suitable type may be evolved from the present beef breeds by selective breeding. Each method has its advocates, and it is hazardous yet to say which policy is likely to prevail.

In these days, when the optimist in agricultural matters is often "a voice crying in the wilderness," the stock farmer in Rhodesia may find some comfort in the thought that cultivated pastures may see him out of his present difficulties. In any case, they deserve far more attention than they have received in the past.

Influence of Fertilisation with Potash on the Drying-out of Maize.

By A. D. Husband, F.I.C., Chief Chemist.

At the request of the Maize Association an experiment was carried out during the past season to determine whether an application of potash to the soil would exercise any influence on the drying-out process of maize in the field. The land chosen for this experiment was a half-acre plot on the red dolerite loam at the Salisbury Experiment Station, which had been under cultivation with maize for over 15 years. The plot had been green-manured during the season 1928-29, but had never received any potassic fertilisation since it was first put under cultivation. This half-acre of land was divided into eight equal plots of one-sixteenth-acre,

and each plot received a basic dressing of either raw rock phosphate or a mixture of bone and superphosphate (one-third bone). Four of the plots were kept as controls, two were given muriate of potash at the rate of 100 lbs. to the acre, and the remaining two received the same form of potash at the rate of 200 lbs. to the acre. The arrangement of the plots is shown in the following plan:—

Block 10, *Sections A and B*: *Each Plot Equals* 1-16-*Acre.*

A 4 B & S + 100 lbs. KCl.	A 3 R	A 2 R + 100 lbs. KCl.	A 1 B & S
B 4 R	B 3 R + 200 lbs. KCl.	B 2 B & S	B 1 B & S + 200 lbs. KCl.

B & S = Bone and Super.
R = Rock Phosphate.

Twelve cobs were taken from each plot weekly from the 13th May until the crop was reaped on the 25th June. Moisture determinations were made in duplicate on a representative sample of the grain from each 12 cobs immediately after they were taken from the field. The results from the moisture determinations are detailed in the following table:—

Plot	A1	A4	B1	B2	A3	A2	B3	B4
Treatment	Bone and super. *No potash*	Bone and super, plus 100 lbs. KCl	Bone and super, plus 200 lbs. KCl	Bone and super. *No potash*	Rock. *No potash*	Rock, plus 100 lbs. KCl	Rock phosphate, plus 200 lbs. KCl	Rock phosphate. *No potash*
Date sampled	Moisture per cent. in grain	Moisture per cent. in grain	Moisture per cent. in grain	Moisture per cent. in grain	Moisture per cent. in grain	Moisture per cent. in grain	Moisture per cent. in grain	Moisture per cent. in grain
13.5.31	19.4	18.4	15.6	16.0	17.6	18.0	16.0	16.6
20.5.31	14.8	13.7	16.7	17.1	14.5	15.7	13.6	14.5
28.5.31	14.1	13.5	14.2	12.8	14.0	13.6	13.1	13.5
4.6.31	13.1	12.6	14.4	12.9	14.1	12.9	13.5	12.6
10.6.31	12.7	12.8	12.2	11.8	13.8	12.3	12.4	12.0
17.6.31	12.8	13.0	12.4	12.1	12.2	12.4	13.1	12.4
25.6.31	12.0	11.5	12.2	11.8	11.7	11.5	12.3	12.0
Final composite sample. Maize reaped 24.6.31								

From the above figures it will be seen that the moisture content of the grain is extremely variable until the end of May, but from this date onward until reaped the moisture content in the majority of cases varies but little. There is no uniformity in the results and no indication that the application of the potash to the soil has accelerated in any way the drying out of the grain.

Blair, of the New Jersey Agricultural Experiment Station, in a recent publication, states that the results of certain liming trials carried out in New Jersey indicate that liming tends to give uniform ripening and drying of the corn, and that maize grown on acid soils does not mature and dry out quite so early as maize grown on soil containing a fair supply of lime. It is interesting to note that most of the plots used in these liming trials had received among other fertilisers a dressing of muriate of potash at the rate of 160 lbs. to the acre. If these results are applicable to this Colony, it would appear that our efforts to increase the rate of drying out of our maize must proceed more along the lines of liming than upon the fertilisation of our soils with potash.

In order to test this point, the Chief, Division of Plant Industry, has kindly agreed to place at our disposal maize being grown on his liming trials at the Salisbury Experiment Station, and an attempt will be made to carry out this work during the coming season.

Summary.—Applications of muriate of potash to the soil exercised no influence on the moisture content of maize.

Reference.—Blair, A. W., 1931, *Journ. Agric. Res.*, Vol. 42, No. 11, pp. 773-774.

Acknowledgment is made to Mr. H. C. Arnold, Manager of the Salisbury Experiment Station, who carried out all the field work in connection with this experiment.

Munga as a Crop.

The following letter has been received from Brigadier-General C. P. Higginson, Wendiri, M'Sonneddi, and will undoubtedly be of general interest.—Ed.

It seems to be a general opinion amongst farmers that pearl millet, more generally known as munga, is a crop which does not pay for the difficulties of reaping and the depredation of small birds.

As we require quite a number of bags per annum for poultry food, we decided to try and grow sufficient for the poultry and other birds as well, more especially as Mr. Copley, our very near neighbour, had previously reaped five bags per acre from about two acres broadcasted.

The best method of sowing seemed uncertain; it was decided that broadcasting was unsatisfactory, as the crop was apt to be too thick and does not admit of cultivation.

Eventually we allowed the same distance between drills as for maize, marking the lines with a planter, sowing thickly by hand and thinning out to about eight inches in a row. The same cultivations were given as for other crops.

A field of ten acres was planted on the 12th December; reaping extended over the first fortnight in April; thrashing was as usual; the seed was cleaned by passing twice through a winnower. Unfortunately the whole crop does not ripen at the same time and consequently requires going through several times.

It is advisable to take measures to keep off birds; this was done by a system of hanging bright tins from "tambo" well above the crop, operating the same from a neighbouring tree at certain times of the day when the birds feed. This is the method employed by natives in districts where munga is grown.

Mr. Dobbin, of O'Meath, also grew munga successfully this year. He was somewhat surprised at its use as a feed

for stock. One of his bulls was in very low condition at the end of the season and did not pick up in spite of careful feeding and attention until a ration of munga was added to his feed. The improvement in a week, Mr. Dobbin tells me, was extraordinary.

It would appear from this that all farmers should carry a certain amount of this grain. It is very much cheaper than linseed and apparently equal to it as a stock feed. It is a necessary poultry food, and pigs, I believe, do well on it.

I think that all farmers should consider the advisability of growing a few acres of munga to supply their own requirements.

Note by the Chief, Division of Plant Industry.

The need for protecting the crop from birds, the usually small yield of grain per acre and the labour of harvesting have generally rendered munga an unpopular crop amongst European farmers in South Africa. It has been tested on the Experiment Stations of Southern Rhodesia in comparison with other grain and fodder crops, but has not shown to advantage. It appears to prefer light, sandy soils to a heavier type of land. The immature fodder is suitable for conversion into silage or hay.

As General Higginson suggests, the crop is probably deserving of the attention of poultry farmers who have sandy or sandy loam soils on which to produce it. The grain is not usually regarded as of much importance in the feeding of other classes of live stock.

The Increased Tobacco Duty.

Mr. Philip Snowden, Chancellor of the Exchequer, opened the supplementary Budget on 10th September. Dealing with tobacco, he said:—

> "I have also selected tobacco as a suitable article to bear an increased duty in the present circumstances, and I propose that as from to-morrow the Customs duty on imported leaf—that is, the unmanufactured form of tobacco—shall be raised from 8s. 10d. per lb. to 9s. 6d. per lb. That is an increase of 8d. The rates of duty on other forms of tobacco will be increased in the same proportion. I estimate this addition will yield £4,000,000 in a full year, and £2,100,000 this year. I have no reason to anticipate that the whole of this increase will be passed on to the consumer."

A lively discussion took place on the increased tobacco duty in the House of Commons on 16th September, and it is thought that the following extracts will be of interest:—

> *Mr. Amery.*—". . . I have risen just for a moment to point out the connection of this particular duty with the very difficult problem of the balance of trade and the position about which we heard so much yesterday. In connection with that position the trade which involves us in the heaviest direct loss of gold is that which consists of our imports from the United States of America. The overwhelming bulk of our purchase of tobacco, averaging about £15,000,000 a year, has in recent years come from the United States. The figures are slightly lower for last year, but the average is about £15,000,000.
>
> "In view of our immense deficit on our general trade balance with the United States, the fact that for the last six years they have sent us £140,000,000 a year more than we have sent them, means that this

purchase of tobacco has drawn directly to that extent upon our stock of gold or gold credits which we obtain elsewhere. On the other hand, the purchase of tobacco from the British Empire is quite different. A very large part of our tobacco purchases from the Empire come from the Crown Colonies—Nyasaland is not a Crown Colony—and these territories are actually on the sterling exchange. This currency is kept at par and level with the sterling by the establishment of sterling boards, and our purchases of tobacco, although they figure in our total list of imports, involve no strain on the gold standard whatever, no more than if we bought our tobacco from Scotland or from other parts of the United Kingdom. When we buy our tobacco from the Dominions or Colonies with responsible Governments, like Southern Rhodesia, their imports to this country naturally correspond to our imports to them, and buying from them does not involve a serious strain upon the gold standard. As far as we purchase from them so they are ready and able to purchase from us. . . .''

Later in the debate Sir William Wayland said:—

"It is possible now to purchase Empire tobacco every bit as good as the best tobacco sold to us by the United States. In regard to cigars, it is possible to buy cigars manufactured in the Empire, from tobacco grown in the Empire; Jamaican cigars, for instance, which, in my opinion, are every bit as good as Havana cigars. Candidly, I cannot afford Havana cigars, even if I wanted to have them, and I much prefer the Empire cigar. . . .

"I hope to see 1½d. an ounce placed upon tobacco, with 1d. of that 1½d. as preference in favour of Empire-grown tobacco. If that had been done before we should have seen a considerable reduction in the amount of foreign tobacco consumed in this country and an increase in the sales of Empire tobacco, which would have meant an increase of the wealth of our people overseas, and would have enabled them to increase their purchases of manufactures from this

country. I hope that that point will be taken into consideration by some Chancellor of the Exchequer in future Budgets. . . ."

And later, Major Walter Elliot:—

"I ask the House to consider the consumption of tobacco and the revenue derived from it in recent years. The consumption of tobacco in 1913-14 was 98,539,000 lbs. In the years after the war that consumption rose to 125,678,000 lbs. It may be said that a great change in habits took place during the war; that the Army trained all male subjects to smoke, and that the increase of smoking among women was also responsible for a good part of that increase. But the increase did not stop there. The consumption of tobacco in 1924-25 had reached 129,103,000 lbs., and in the year 1928-29 it had reached 141,000,000 lbs. That is not the end of the story. In 1929-30 it went up to 151,000,000 lbs., and in 1930-31 to 154,707,000 lbs. It is clear that any Chancellor of the Exchequer looking for revenue would be bound to take notice of the increased consumption of this commodity—luxury or necessity, whichever it may be called. I do not deny that the hon. member for the Scotland Division of Liverpool (Mr. Logan) has said that to a hard-up man, to a navvy or a docker, a "dottle" of black twist in the bowl of his pipe may be a great solace. Still, a Chancellor of the Exchequer in the circumstances I have mentioned sees this commodity, which he has already taxed, showing an increase in consumption of 13,000,000 lbs. between 1928 and 1930. He is bound to see that the weight of taxation which has been imposed upon it so far has done nothing to check the consumption of that commodity.

"The Chancellor of the Exchequer therefore proposes an increase in the duty upon that commodity. The duty which is already taken from tobacco is considerable. The increase, which is £2,100,000 this year, will be in addition to a revenue which is well over £60,000,000 in the year. I do not think that it can be contended that a revenue which has risen from

£59,000,000 sterling in 1928-29 to £64,000,000 sterling in 1930-31 is not a revenue which would inevitably attract the attention of a Chancellor of the Exchequer seeking the ways and means of meeting a great deficit in his Budget."

After a lengthy discussion the House divided: Ayes, 287; Noes, 213.

Gwebi Produce Prices.

Hull-less oats	40/- per bag of 150 lbs.
Large Black sunflower seed ...	14/- per bag of 100 lbs.
Dolichos beans	35/- per bag of 200 lbs.
Linseed	60/- per bag of 200 lbs.
Linseed (quantities under 100 lbs.)	4½d. per lb.
Sweet potato tubers (Calabash Leaf)	6/- per bag of 150 lbs.
Napier fodder roots	6/- per bag of 40 lbs.
Sweet potato cuttings (Calabash Leaf)	6/- per bag of 40 lbs.
Edible canna corms	10/- per bag of 150 lbs.
Pumpkin seed	1/1 per lb.

All prices quoted are for *delivery free at any station or siding* in Southern Rhodesia. Before sending cheques, intending purchasers are advised to ascertain that the seeds, etc., required are still available. Cheques should be made payable to "Gwebi Farm." All orders and enquiries should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury, *not direct to the Gwebi Farm.*

Insecticides and Fungicides.

It has recently been estimated, by a competent authority, that not less than one-tenth of the human effort in the Empire on basic industries, such as agriculture, is dissipated by insect pests. It is concluded that since the population of the Empire may be estimated at about 450,000,000, an additional population of some 45,000,000 could be supported by the same effort as is now exerted, if it were possible to eliminate insect pests.

At the Imperial Agricultural Research Conference in 1927, the following resolution was carried:—

> "That, in view of the general importance of insecticides and fungicides in the control of diseases and pests, and, in view of the very limited number of substances available now for this purpose, and of their relative inefficiency, this joint meeting of members of the Entomology, Plant Pathology and Fruit Committees recommends that an investigation of the whole chemical field should be undertaken by chemists working in collaboration with entomologists and plant pathologists."

A committee was formed to report on the action necessary to carry this resolution into effect, and the committee referred to the fact that, whilst no statistics are available of the total consumption of insecticides and fungicides within the Empire for the purpose of demonstrating the outstanding importance of the subject, some idea might be gained from other considerations. There are, for example, at least 4,000,000 acres of fruit within the Empire; if only one-quarter of this area were sprayed only twice a year, not less than 1,000,000,000 gallons of spray fluids would be used. Taking the average cost of the spray fluids as 1d. per gallon of dilute wash, the expenditure on chemicals for spraying would not be less than £4,000,000 a year, apart from the labour in applying them, and, if labour costs are included,

can hardly be less than £10,000,000. The committee pointed out that, in view of the immense issues at stake, it is remarkable that up to the present so small an effort has been made to discover substances having valuable fungicidal and insecticidal properties, and to find how these properties can be turned to useful account.

The committee recommended that, in order to give effect to the terms of the resolution, it is desirable that a central team of workers should be placed at the East Malling Research Station, Kent, and that additional staff should be provided at the Horticultural Research Station, Cambridge, at the Rothamsted Experimental Station, at Long Ashton Research Station and at the South-Eastern Agricultural College, Wye. The total expenditure for a period of five years would be approximately £4,600.

A copy of the committee's report was forwarded to this Department by the Empire Marketing Board, with a request that the Board might be furnished in due course with the Department's observations, with particular reference to the interest and possible application of the scheme to problems in Southern Rhodesia, and also with any suggestions which could be offered for linking up the proposed research with work already undertaken or in progress here.

A reply was sent indicating that we are not in a position to offer any criticism of the scheme, but endorse the opinion of the committee that research is urgently needed to discover insecticides and fungicides of greater efficiency, and, if possible, at a lower cost than those generally in use at present.

It was pointed out that the necessary highly trained staff and other facilities required are available in Great Britain, and, without doubt, the greater part of the work should be carried out there.

On the other hand, the range of insect pests and diseases available for testing out new insecticides and fungicides in Great Britain is limited, and it was indicated that we would be very glad to co-operate in this type of work and carry out any tests required, and report the results to the Central Committee.

Review.

A New Periodical: "Nutrition Abstracts and Reviews."

Research work in a variety of subjects is being carried on by such an army of workers at so many centres scattered over the world that it is quite impossible for anyone to keep in touch with all of it. Journals and reports are being constantly published, but it would be too much to expect anyone to subscribe to all of them. For this reason it was recommended at the Imperial Agricultural Research Conference in 1927 that machinery should be developed to overcome this difficulty in respect of those branches of agricultural science which are of particular importance at present, and considerable progress has already been made.

Beginning with October, 1931, a new quarterly periodical has been published by the Imperial Bureau of Animal Nutrition entitled "Nutrition Abstracts and Reviews."

According to the prospectus an attempt will be made in this journal to collect abstracts of all papers which have a bearing on problems of nutrition. The abstracts will be made, as far as possible, by workers actually engaged in research.

The branches of the general subject which will be reviewed in the journal include the following: Technique; chemistry and properties of foodstuffs; physiology of nutrition; human dietetics; feeding of farm animals; diet and health, including deficiency diseases; therapeutic dietetics and food economics.

The subscription will be £1 per volume or 6s. 6d. per number, and subscriptions should be sent to the Secretary, Imperial Bureau of Animal Nutrition, Rowett Institute, Aberdeen.

Farming Calendar.

December.

BEE-KEEPING.

With a normal season the first or main honey-flow of the year should now be over and the honey ready to be robbed. Before doing this, see that all or the main portion of the frames are capped and sealed, otherwise there will be trouble later on by fermentation. There is nothing on the market to equal the Porter bee-escape board to clear out the bees from the crate, but be sure and see that the board in question is placed the right side up under the crate; failure to do this (and in the hurry of the minute it can easily be so done) will result in the probable suffocation of the bees and the loss of the honey, to say nothing of the chances of robbing from any close-by hives. Replace the empty combs and frames as soon as possible on the hives, to be cleaned up and mended where necessary, and for future storage of more honey. During the very hot spells watch the hives and provide extra ventilation, by inserting small metal wedges between the crates, just wide enough to allow air in, but not a bee under any consideration. Keep all water tins under the hive-stand legs full of water, and see that water is available for the worker bee, which drinks a good deal. When extracting honey, do so in a bee-tight room or verandah, otherwise the operator may have a lot of trouble from other colonies, which quickly find where honey is. Always have one or more crates of shallow frames ready with foundation fixed to place on hives as the season may warrant; such will mean always something for the bees to work at, and during the last flow they may be invaluable to store any such catch crop of nectar, as from tobacco, etc., when the natural flora is finished.

CITRUS FRUITS.

This is a good month to plant citrus trees into their permanent positions. They should on no account be planted deeper than they stood in the nursery. Water each tree immediately after planting it to settle the soil, then loosen the surface when sufficiently dry to check weed growth and restrict evaporation; continue loosening the surface soil after each rain or watering. If good rains have fallen, disc the grove in two directions, then sow the cover crop and harrow also in two directions. If the grove is weedy it should receive a shallow ploughing in place of the discing. Then sow the seed and harrow the soil. All bearing trees must be kept well watered if the weather continues to remain dry. Trees that suffer for want of moisture while the young fruit crop is developing will be adversely affected, and the crop—if any—will be of inferior quality. Continue to rub off all water shoots or suckers which develop on the tree stems.

CROPS.

Keep the cultivators going, both on planted and unplanted lands, whenever weather conditions are favourable. Destroy the weeds while young and before they obtain a firm root-hold.

Continue planting maize, cotton, beans and ground-nuts as early as possible this month, followed by sunflowers, Sudan grass, manna, pumpkins and cattle melons. Linseed, cowpeas, teff grass, oats, Sunn hemp

should be planted after the other crops are in. Ensilage crops may be sown at the end of the month. When harrowing maize after planting, this work should be done in the heat of the day when the young plants are flaccid and not easily broken. On lands not yet planted the crop of weeds should be kept down by disc-harrowing. It is a good plan to harrow or disc-harrow immediately before the planter, or alternatively to follow the planter with a light harrow. Treat seed oats for smut before sowing. Use one pint of formalin to 25 gallons of water and steep the bag of seed for ten minutes. Earth up early planted potatoes. Keep a look out for the stalk-borer, and top or otherwise treat affected plants. New lands and old pastures may be broken, as circumstances permit, during December, January and early February, and again ploughed in from May to July. If they carry a heavy crop of grass it should be cut or burnt to enable good, clean ploughing to be done. Sweet potato slips should be planted early in this month. Do not fail to have in a few acres of this valuable crop.

DAIRYING.

During the months of December and January veld grazing is usually plentiful, and very little extra feed in the form of concentrates is required for dairy stock. It should be borne in mind, however, that heavy milking cows are unable to satisfy their requirements for milk production from veld grazing alone, and should receive a daily allowance of grain; the latter should be fed at the rate of 2 lbs. for every gallon of milk produced daily, i.e., a cow producing three gallons of milk should receive 6 to 7 lbs. of concentrates. An excellent mixture for this purpose is one consisting of four parts maize meal and one part ground-nut cake.

During wet weather, the provision of a clean dry shelter for calves is essential; the latter should not be crowded together in a small, damp, badly ventilated pen or muddy kraal. When treated in this manner, a calf is very liable to contract various ailments such as scour, etc. Scour is entirely preventable, and is usually caused by over feeding, or feeding from dirty pails, feed boxes, etc. Calves which contract scour should be isolated, the milk ration reduced, and they should be dosed with a few tablespoonfuls of castor oil.

Under the weather conditions which now obtain, cream should be despatched to the creamery at least three times a week. It is of the greatest importance that cream should be cooled immediately after separation, and should be kept cool while on the farm and whilst in transit to the railway station or siding. While the cream is being cooled, it should be frequently stirred, using a stirrer with a plunger attachment. Warm, freshly separated cream should not be mixed with old cream which has already been cooled. Cool the fresh cream first and then mix thoroughly with the old cream. Gassiness is a common defect in the cream received at the creameries at this time of the year, and is caused by gas-producing organisms with which the milk and cream are contaminated. These organisms abound in mud, manure, etc., and develop and multiply very rapidly at high temperatures. Any precautions therefore which may be taken to eliminate dirt, manure, etc., from the milk and to keep the cream cool will prevent the development of gassiness.

As the night temperatures are fairly high, cheese-makers should not attempt to use night's milk for cheese-making; morning's milk plus a starter will give the best results. Gouda cheese-making operations are not usually successful at this season of the year, owing to the poor quality of the milk and the prevalence of gassiness. This type of cheese is best manufactured during March and subsequent months.

DECIDUOUS FRUITS.

Cover crops may be planted when the rains commence, as recommended under citrus fruits. Summer pruning may be commenced this month. If all undesirable shoots are taken out of the trees, the remaining shoots will receive sufficient air and light to mature. Ripening fruit must be carefully

harvested, graded and packed if satisfactory prices are to be secured. Do not gather any fruit when it is wet. Keep all recently planted trees in good condition; the first year's growth is the most important. If the undesired shoots are rubbed off when they first appear, the retained shoots will receive all the nourishment and the tree will then grow to a large size.

ENTOMOLOGICAL.

Maize.—The first half of this month appears to be the best period during which to plant maize for the avoidance of stalk borer attack—at least in the Salisbury district. Hoe out and remove volunteer maize plants before the new crop is up, as they are liable to be infested with borer, which tends to spread to surrounding plants.. Red soils may be baited with chopped Napier fodder or other suitable greenstuff dipped in arsenite of soda 1 lb., cheapest sugar 8 lbs. or molasses 1 gallon, water 10 gallons, to destroy surface beetles, snout beetles and other insects which may affect the primary stand.

Tobacco.—The enemies of this crop are in general most active during December, whilst the crop is still in the early stages of growth.

For information regarding tobacco pests, see "Rhodesia Agricultural Journal," January, 1928, or Bulletin No. 665.

In general, poisoned baits may be used against surface beetles, grasshoppers, crickets and cutworms. Against surface beetles, arsenite of soda 1 lb. in 30 gallons of water used to moisten maize bran is a good bait. Against grasshoppers and crickets the addition of 8 lbs. sugar or 1 gallon molasses to each 1 lb. of arsenite of soda is recommended. Spray with arsenate of lead (powder) 1 lb. in 30 gallons of water against leaf-eating insects and as a protection against leaf miners and stem borer. Transplants may be dipped head downwards as far as the roots in the poison. Discard seedlings infested with stem borer and root gallworm.

Cutworms.—Keep ground around seed beds as free as possible from vegetation, to prevent female moths from laying eggs there. From the time the plants show foliage of the size of a sixpence they should be sprayed weekly with arsenate of lead (powder) 1 lb. to 30 gallons of water. This should prevent cutworms developing in the beds, as the young cutworms attack the leaves of the seedlings, and so ingest the poison.

House Flies.—With the coming of hot weather and the rains, house flies greatly increase, and should be kept out of dwelling houses by mosquito netting, or poisoned in the following way:—Dissolve 1 lb. of sodium arsenite in 10 gallons of water, and add about 10 lbs. of cheap sugar (2 gallons of treacle) or other sweet substance. The mixture should be sprayed upon branches of shrubs or trees, which may be hung up in convenient places where flies congregate. These insects are attracted to the bait, and are easily poisoned.

Mosquitoes, Stable Flies.—Destroy breeding places around homestead. Poison or trap adults.

Potatoes.—Ladybirds and caterpillars may be injurious to the foliage, and on sandy soils blue blister beetles sometimes cause damage. Spray with arsenate of lead (powder) 1 lb. to 25 gallons of water.

Kitchen Garden.—Marrows, etc., are commonly attacked by leaf-eating beetles. Spray with arsenate of lead (powder) 1 lb. in 25 gallons water, plus 8 lbs. cheapest sugar or 1 gallon molasses. Dusting lightly with pure arsenate of lead powder should give protection. Young plants of the cabbage family may be dusted with pure arsenate of lead powder or with such powder mixed with up to six or eight parts of finely sifted, thoroughly slaked lime as a protection against leaf-eating insects.

Fruit Trees.—The regular collection and destruction of fruit beetles may be necessary. Choice varieties of peaches, etc., may be netted as a protection against pests.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

FORESTRY.

Final preparations for planting should be made, including harrowing or pitting. Early plantings may be carried out if the season is a good one. Planting should be carried out on dull, rainy days, or failing such days, late in the afternoons. Great care should be exercised in planting out to avoid bending the tap root, and to set the trees in the ground at the same level as they were in the seed bed or tray. Late sowings of Cedrela toona seed may be made.

POULTRY.

The poultry keeper should take precautions whereby the wet weather will not affect his birds' health and their laying powers. All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs. Foodstuffs also must be kept absolutely dry.

Many birds will at present be moulting; these require special treatment to bring them through it quickly, and if possible keep them in lay during the period. A pamphlet on this can be obtained from the Poultry Expert, Department of Agriculture. This lack of attention to the birds during the moult is one of the causes of the scarcity of eggs at this season. There is no need for it if poultry keepers would only look after their birds properly.

Those who intend disposing of their turkeys for killing at Christmas must avoid cooping them up, as is done when fattening fowls, for they immediately mope and go off their food. Give them free range, and in addition to their usual evening feed of maize, during the first week of December give one of wheat or maize in the morning, and during the second and third weeks three meals a day, each one containing, in addition to wheat or maize, some crushed monkey nuts or sunflower seeds. Plenty of thick milk and chopped-up onions or onion tops should also be given.

Those who go in for ducks should feed well and get as many to marketable size as possible by Christmas, when they usually fetch good prices. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, maize meal, meat meal and milk, as much as they will eat three times a day, i.e., they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—Ranching cattle should not require any attention beyond dipping, but any stock that are in weak condition will be the better for a little hay or a pound or two of maize at night until they have regained strength. The bulls should be returned to the herd either at the end of the month or in January, and it should be remembered that the better they are conditioned and fitted for their work the more hope there is of a good crop of calves. For this reason also every effort should be made to have all the female stock in strong condition. Dairymen will find

that as the grass becomes lush and rank a supply of sweet veld hay, teff hay or, say, three pounds of crushed maize given in the sheds at night will enhance both the quality and quantity of the milk. This will be found to be the case more particularly in districts of heavy rainfall. Milch cows should be protected as much as possible from cold rains and hot sun. Yarding all night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather. Dipping should be regularly attended to.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on well prepared soil. Transplanting should be pushed on with as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertiliser to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VETERINARY.

Occasional cases of horse-sickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gall-sickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland the rainfall during this month varies from eight inches along the eastern border to six inches in the west. In Matabeleland it varies from five-and-a-half inches in the west to four-and-a-half inches in the south. Considerable divergencies from these normals may occur in individual seasons, but on the whole this month is the most regular in its behaviour. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of very heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight, or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

January.

BEE-KEEPING.

This month is a slack one for actual hive work. Each hive should continue to be carefully watched to see that any attempt by the wax moth to gain a footing is at once stopped. In the great heat of this month, see that proper ventilation is supplied, as well as enough water. Precautions

against the depredations of white and other ants should also be watched daily. Where possible, examine now and again the brood chamber for queen cells, and destroy them if not wanted. Requeening can be done where desired on the uniting system, if the apiarist does not know of the better plan of rearing his own queens. In the workshop have a spare hive or two complete and ready for occupation, well painted, for any new swarms that may be required in the coming months. Though the second honey flow of the season is not due to start until about March or April, there should be ample stores coming in meanwhile to keep all bees busy in breeding, nursing, and bringing the hive generally to full strength for the winter, as well as for their own daily food supplies. There will not be enough honey coming in now for surplus purposes, therefore see that the supers are not left on the hives to a greater degree than to give the inmates plenty of room to loaf in.

CITRUS FRUITS.

The planting of citrus trees should be completed if possible by the end of the month, for trees planted later may not harden up before the winter; they then become susceptible to winter injury from cold. This month is the best one for planting shelter belts to protect all varieties of fruit trees from the prevailing dry winds. Cover or green crops may be planted during this month; if the grove has been over-run with grass or weeds, sow the cover crop seed more thickly. This will assist in smothering future weed growth. Continue suppressing any undesirable shoots that may develop on the tree trunk or other parts of the tree. Drain any depressions that allow rain or irrigation water to accumulate at the base of the trees, for trees permitted to stand in water will speedily fall victims to disease or pest injury.

DECIDUOUS FRUITS.

Continue planting cover or green crops between the trees. These crops may then be turned under towards the end of the rainy season to furnish the necessary humus.

Summer pruning may be continued. Rub or break off any undesirable shoots that have a tendency to crowd each other; suppress all growths on the main stem from the ground level up to the main arms of the tree, for these are unnecessary. If next year's fruit crop is to be of good size and quality, the inner fruiting wood of a tree must receive sufficient air and light to mature fully. If the new growth is too dense it will prevent the fruiting wood from maturing, and poor crops will be the result. The thinning out of the summer growth will overcome this crowding and weakening of the fruiting wood.

Many fruits will be ripening during the month. Do not permit the fruit to become over-ripe on the trees; rather harvest it at the correct stage and store or sell the surplus.

Plant shelter trees if the orchard is exposed to the prevailing winds, as good crops of fruit cannot be expected from inadequately protected fruit trees.

CROPS.

If not already sown, put in the ensilage and fodder crops at once, such as maize and legumes, oats and other hay grass crops. Sow short season crops like haricot beans, linseed, buckwheat, peas, summer oats, gram and mung bean. Plant out grasses and kudzu vine for pasture. Ridge potatoes and cultivate thoroughly. Main crop can still be planted. Quick growing green manuring crops, such as cowpeas, soya beans and sunn hemp, may still be sown this month. Earth up ground nuts so that a small amount of loose soil is thrown over the crowns of the plants. This assists the formation of nuts. If not already done and where practised, legumes or long season oats such as Algerian can be sown under the maize crop for grazing and to add nitrogen and humus to the soil. Cultivate all growing crops well, and thoroughly eradicate weeds. Overhaul

all hay-making implements and ploughs and get in thorough repair in preparation for the haying and ploughing seasons. Endeavour to mow grass fields early for hay and litter, and to obtain second cutting for hay in April. Fallowed lands or fields not yet planted may be disc-harrowed or ploughed to prevent weeds from seeding. Mow grass paddocks infested with annual weeds to prevent the weeds seeding. Prevent Mexican marigold and other noxious weeds seeding by hoeing or pulling out the plants by hand. Keep a sharp look-out for maize stalk borer. Cut off the tops of infested plants or treat them with a recognised chemical preparation. If topping is practised, remove tops from land, and bury, burn or feed them at once to farm stock. Watch the maize lands for witch weed. Prevent witch weed plants from seeding by cultivation and by hand-pulling the plants. Make as much manure as possible by placing grass and litter in cattle kraals, pig sties and stables. If there is stumping and clearing to be done, push on with it. Endeavour to get as much of the new virgin land as possible broken up during this and the two following months.

DAIRYING.

(See December.)

ENTOMOLOGICAL.

Maize.—Late planted maize, particularly crops planted after the New Year, are frequently attacked by the maize stalk borer (*B. fusca*, Full.) in districts where this pest is prevalent. The yield of grain from heavily attacked stands is usually very low, and such crops are most economically used as ensilage. Plants attacked are easily detected in the fields, as the newly hatched caterpillars eat the young leaves before entering the stalk. Top dressing with a suitable insecticide should be employed to ensure a good yield. There are several insecticides which can be used for top dressing which kill the young caterpillars without causing severe injury to the plant. Kerol, Kymac or Hycol used at a dilution of 1 in 300, or Pulvex, 1 in 54 gallons of water, give satisfactory results. A new preparation, Derrisol, is highly recommended by the manufacturers at 1 in 1,000, and is stated to be quite innocuous to the plants. The liquid should be poured into the funnel-shaped cup formed by the young leaves. Only those plants showing attack are usually treated. With a light infestation, one native can treat about five acres per day. Several treatments may be necessary. Young maize plants up to six weeks old can be treated by cutting the plant below the point attacked. The portions cut off must be removed from the lands.

Various leaf-eating insects (including the snout beetle (*Tanymicus destructor*), the surface beetles, grasshoppers, etc.) attack young late-planted maize.

The attack by the snout beetle may be very severe. If there is time, it is often advisable to harrow in the old crop, treat the land with poison bait and re-plant, or poison bait may be used without removing the crop. The best carrier for poison bait is chopped Napier fodder or some other green succulent grass, including maize itself; failing this, maize or wheat bran may be used. The carrier is thoroughly covered or impregnated with a solution of arsenite of soda 1 lb., molasses 1½ gallons, or cheapest sugar 8 lbs., water 10 gallons, and broadcast. The cheapest arsenite of soda to employ is locust poison, diluted 1 in 200, and equivalent quantity of sweetening agent added. The best results are obtained if the broadcasting is done in the evening, as the hot sun dries up the bait too quickly and renders it unattractive to the beetles.

Army Worm (*Laphygma exempta*) may put in an appearance during the latter half of December, and a sharp look-out should be kept for the caterpillars, especially on sweet grasses near the maize lands and on "rapoko grass" (*Eleusine indica*) on the lands. (See *Rhodesia Agricultural Journal*, October, 1930, page 1055.)

Black Maize Beetle.—Both larvæ and adults of this beetle are active during this month. Hand collecting of the adults is the only practical procedure. For further control measures, see *Rhodesia Agricultural Journal*, February and April, 1925.

Potatoes.—This crop, if attacked by leaf-eating ladybirds, blister beetles or other leaf-eating insects, may be sprayed with arsenate of lead (powder), at the rate of 1 lb. in 25 gallons of water. This poison may be combined with Bordeaux Mixture when spraying against early blight. To protect potatoes from potato tuber moth, the rows should be ridged deeply and the tubers kept covered with soil.

Tobacco.—Tobacco in the field is attacked by many insects during this month, and growers should keep a copy of Bulletin No. 665, "Tobacco Pests of Rhodesia," handy for reference, or refer to *Rhodesia Agricultural Journal* for January, 1928. The following very brief account of the more common insect pests attacking this crop may help the grower who cannot consult the above-mentioned bulletin.

Cutworms.—Keep all lands free from weeds up to the time of planting out.

Stem Borer.—All seedlings showing the characteristic swelling should be destroyed by fire. Plants in the field should be destroyed and replaced, or the plant may be cut off below the swelling and one sucker encouraged to grow. The latter procedure needs to be carried out early.

Leaf Miner.—All primings should be destroyed, and infected leaves may be picked off.

Seed Beds.—Seed beds which are no longer required should be cleaned up and not allowed to become a breeding ground to infest the fields. Beds in use should be kept properly covered with limbo and sprayed weekly with arsenate of lead, 1 lb. in 30 gallons of water.

Wire Worms (*Trachynotus* spp.).—Several species of wire worms attack this crop during January, particularly on sandy soils. It is now too late to attempt control. Control depends upon the accurate timing of the emergence of the adult beetle and poisoning with a poison bait. Emergence usually takes place late in April or in early May. The bait consists of maize meal or bran poisoned with arsenite of soda (locust poison, 1-200). The bait is made up into balls, scattered about the lands. The balls should be covered with leaves, to give attractive shade and to assist in keeping the bait moist. Moisture should be added when necessary.

Surface Beetles (*Zophoses* spp., *Gonocephalum* sp.).—The same control measures apply as for wire worm. Baits recommended against wire worm can be applied during January. No sweetening matter is necessary.

Bud Worm (*Heliothis obsoleta*).—Destroy all caterpillars by hand during "topping." Examine all bagged seed heads weekly and destroy any caterpillars discovered.

Other Leaf-Eating Caterpillars.—A bad attack in the field may be controlled by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water. A knapsack spray pump with a cyclone nozzle is necessary. Hand picking may be employed.

Beans, Cowpeas, etc.—Haricot beans and cowpeas are liable to attack by the stem maggot (*Agromyza* sp.). This small fly deposits its eggs in the young leaves, often within a few days of germination. The larvæ mine along the veins and down the stem, pupating about soil level. Practically nothing can be done to protect a field crop. Velvet beans, Jack beans and dolichos beans are not attacked by this pest.

All varieties of beans are attacked by a leaf-eating beetle (*Ootheca mutablis*). This small insect can be controlled by spraying with arsenate of lead (powder), 1 oz. to 3 gallons of water.

Blister beetles are often very numerous on the flowers of all species of beans and cowpeas. Hand collecting has been found to be the most economical measure.

The bean stem weevil is a minor pest of beans in the kitchen garden. All plants attacked by this weevil should be picked out and burnt.

Sweet Potatoes.—Sweet potatoes may be attacked by caterpillars of the sweet potato sphinx moth. These should be collected by hand.

Kitchen Garden.—Marrow and cucumber plants about to set fruit may be sprinkled regularly with the following formula to destroy fruit flies which "sting" fruit :—Arsenate of lead (powder), 1½ ozs.; molasses, ½ gallon, or cheapest sugar, 2½ lbs.; water, 4 gallons. To destroy leaf-eating insects generally, dust plants with arsenate of lead (powder), 1 part in 20 parts of finely-ground maize meal or finely-sifted slaked lime. *Aphides* (plant lice) may be treated with soap, 1 lb. in 5 gallons of water, or tobacco wash, or simply by regular spraying with a forceful stream of cold water from a spray pump.

Fruit Trees.—Deciduous fruits are subject to attack by large beetles, which should be destroyed by jarring into a net and dropping thence into a tin containing water, with a film of paraffin on the surface. Trees should be covered in mosquito netting to protect the fruit from fruit-piercing moths. The large adult beetles of the fig borer may be seen on the young shoots and should be destroyed. Borers in the trunks of the trees may be killed by injecting a little carbon bisulphide.

Mosquito, House Flies, etc.—Screen windows and doors. Destroy breeding places around homestead. House flies may be poisoned cheaply with sweetened arsenite of soda solution. Write for directions.

When in doubt as to the identity of any pest or the method of dealing with it, apply promptly to the Chief Entomologist, Salisbury, bringing or sending specimens of the insects concerned. Note, however, that it is sometimes feasible to prevent injury from pests for which no practical remedy is known. Farmers should therefore endeavour to obtain some knowledge of the pests of the crops they are growing through the articles published in this Journal.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

VEGETABLE GARDEN.

Turnips, carrots, cabbages, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or, failing that, on a dull day, or late in the afternoon. Great care should be taken to see that the trees are not planted out any deeper than they stood in the tins.

POULTRY.

All houses must be absolutely watertight, the floor raised well above the level of the surrounding ground, thus preventing water seeping in and making it damp. The birds themselves should not get wet, and no pools of water should be seen in the runs.

Foodstuffs must be kept absolutely dry, otherwise they will become mouldy and sour, causing disturbance of the intestinal tract, illness, and perhaps death; certainly a diminution in the number of eggs.

Some of the birds will now be in moult. To get them through it quickly give more sunflower seed, some monkey nuts, plenty of green food, especially cabbage, kale, etc., plenty of milk or some meat, a little sulphur in the dry mash (one teaspoonful to 1 lb.); also stew two dessert spoonfuls of linseed in a pint of water to a jelly, mix this to a crumbly consistency with mealie meal or bran, and give about one dessert spoonful to each bird daily. Keep the birds dry during the rains, otherwise the egg output will decrease.

Do not hatch any more turkeys till after the rainy season is over. Turkeys should not be penned up, but allowed on free range.

Ducks must be treated in almost exactly the reverse manner to what turkeys are. They should be kept in a small run; nearly all their food should be wet mash, bran, pollard, mealie meal, meat meal and milk, as much as they will eat three times a day, *i.e.*, they should practically be allowed to spend their existence eating and sleeping. Big duck breeders often give a fourth meal by lamplight at 10 p.m., and the first meal is given at sunrise.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Bulls should be returned to the herd during the month if a September or October calving season is desired.

Sheep.—Continue as recommended for December. If heavy rains are experienced a daily ration of a quarter of a pound of maize per ewe will keep them in condition, and will often prevent much trouble arising from poverty and anæmia. Those who favour autumn lambs must put the ram again with the flock in February, and should therefore now take steps (if necessary) by supplying a little extra feed as above recommended to fit the ewes for mating. A little forethought of this kind will tend to increase the stamina of the lambs and to bring the ewes in season more or less together, so that a protracted lambing season is avoided.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth, so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform and disease-free plants for producing seed for next season's crop. All plants should be properly primed at the same time that the tobacco is topped.

VETERINARY.

Horse sickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, eight in the north, and seven to seven and a half as one travels westwards or southwards. At this time of the year the rainfall tends to be heavier in the eastern than in the western portions of the Colony, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

Southern Rhodesia Veterinary Report.

September, 1931.

AFRICAN COAST FEVER.

SALISBURY.—Two cases occurred on the infected farm Loielei.

FOOT AND MOUTH DISEASE.

(Special report published in November *Agricultural Journal.*)

TRYPANOSOMIASIS.

MELSETTER.—The District Veterinary Surgeon states that cases are being reported with regular frequency on farms along the eastern border, and that buffalo have been more often seen on some of the affected farms than in previous years.

HARTLEY.—Fly has been more frequently seen in the Gatooma area of late, but the number of animals becoming fly struck has not increased.

SNOTZIEKTE.

This disease was diagnosed on a farm in the Bulalima-Mangwe district. A few deaths occurred.

SCAB.

Several herds have been treated.

IMPORTATIONS.

From the Union of South Africa: Bulls 18, cows and calves 12, heifers 2, horses 19, donkeys 16, sheep 2,216, goats 92.

EXPORTATIONS.

Nil.

October, 1931.

AFRICAN COAST FEVER.

Melsetter.—Smears from a calf on the farm Hillside showed African Coast Fever. This farm is in the immediate vicinity of that section of the Tilbury Estate on which a heavy infection occurred some months ago. Pending valuation for purposes of slaughter, the herd, 83 head, is under close observation and control.

Gwanda.—The last area under quarantine was released from all restrictions.

FOOT AND MOUTH DISEASE.

A special report was published in the October issue of this Journal.

TRYPANOSOMIASIS.

Several deaths of cattle reported from the Melsetter district.

In the Gatooma district cases occurred in two herds of cattle not affected previously.

SCAB.

Three outbreaks in sheep in the Melsetter district.

IMPORTATIONS.

From the Union of South Africa:—Bull, 1; cows, 20; horses, 7; donkeys, 66; Sheep, 2,306; goats, 188.

EXPORTATIONS.

Nil.

J. M. SINCLAIR,
Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

OCTOBER, 1931.

Pressure.—Mean barometric pressure was uniformly high at all stations.

The month was marked by the rapid passage of a number of southerly lows, seven in all. The equatorial low was active for the first four days of the month and appeared on and off for the first fortnight. From the 14th onway the pressure was controlled by a succession of five southerly lows separated by highs.

Five highs of importance appeared during the month. They all appeared on the west and south-west coasts and moved round the coast at average velocity. Towards the latter end of the month they showed a tendency to remain off the coast and not to extend overland to the west.

Temperature.—Monthly mean temperatures were low in the south and west and high in the north and east.

Rain Periods.—Showers were reported from the 4th to the 8th and were numerous on the 5th. Numerous showers fell on the 12th and a few were recorded on the 11th and 13th. Isolated showers fell on the 18th, 19th and 20th. Scattered showers fell on the 22nd, increasing to numerous on the 23rd, scattered on the 24th and were fairly general on the 25th. Scattered showers only were reported from the 26th to the 28th. On the 29th and 30th showers were fairly general in the south and on the 31st isolated showers occurred.

Rainfall.—The mean rainfall for the month was about 0.1 inch above normal and was distributed as follows:—

Zone.	October, 1931.	Average, October.	Percentage.
A	0.76	0.76	100
B	2.08	0.90	231
C	0.25	1.02	25
D	0.35	0.90	39
E	1.58	1.14	132
F	1.26	1.84	68

OCTOBER, 1931.

Station.	Altitude	Pressure 8.30 a.m.	Temperature ° F.						Humidity, 8.30 a.m.		Precipitation.		
			Absolute.		Mean.			Diff. from Normal.	Wet Bulb.	%	Ins.	Diff. from Normal.	No. of Days.
	Feet.	Mb.	Max.	Min.	Max.	Min.	½ Max. Min.						
Bulawayo ...	4,440	870.0	94.3	49 0	84.1	59.6	71.9	−0.3	58.9	48	0.84	−0.1	4
Gwelo	4,632	864.4	94.0	48.0	86.0	59.2	72.6	+0.1	59.1	46	0.17	−0.6	2
Riverbank ...	4,100	...	99.0	54.0	88.3	61.8	75.1	−0.8	60.6	56	0.70	...	4
Essexvale ...	3,828	...	100.0	45.0	87.2	59.7	73.5	−1.1	59.7	54	3.43	+2.6	5
Gwanda ...	3,235	...	98.0	52.0	84.3	61.6	72.9	...	61.3	53	2.05	+1.1	6
Mazunga ...	1,970	949.9	102.0	51.5	86.8	61.1	73.9	−2.6	62.8	57	1.74	+0.8	6
Nuanetsi ...	1,630	...	103.0	46.0	86.8	62.3	74.6	...	65.3	76	4.26	+3.3	8
Between Rivers	3,970	...	97.8	42.6	91.0	61.7	76.4	...	60.8	40	0.05	−1.3	1
Enkeldoorn ...	4,720	...	94.0	50.0	84.8	58.2	71.5	+0.3	59.7	45	0.90	−0.4	3
Gatooma ...	3,850	...	98.0	45.0	91.9	60.6	76.3	+0.1	61.1	39	0.66	−0.4	5
Miami	4,090	...	95.0	50.0	88.2	63.1	75.7	...	60.7	39	0.94	+0.7	1
Salisbury ...	4,865	856.5	92.2	51.6	85.0	60.5	72.8	+2.1	57.9	43	1.91	+0.6	3
Sinoia, Citrus ...	3,830	...	...	45.0	...	61.1	...	...	65.1	53	...	...	...
Sipolilo... ...	3,900	...	92.0	54.0	87.4	65.7	76.6	...	61.8	41	...	...	...
Juliasdale ...	6,070	...	86.3	42.0	78.3	53.9	66.1	+2.6	56.4	50	0.08	−1.3	2
Mtoko	4,210	...	...	...	...	...	...	...	...	...	...	...	...
Shamva ...	3,170	...	100.0	50.0	91.4	63.9	77.7	...	...	...	0.17	−0.3	1
Angus Ranch ...	2,300	...	104.0	54.0	88.4	65.8	77.1	+0.2	65.5	60	2.85	+2.0	5
Craigendoran ...	3,430	...	104.0	51.0	91.9	62.0	77.0	...	64.9	46	0.39	−0.3	3
New Year's Gift	2,700	...	100.1	52.3	86.7	61.7	74.2	...	62.8	58	0.44	−0.7	4
Nyamasanga ...	5,080	...	90.0	40.0	82.5	54.0	68.3	...	59.9	45	1.33	...	5
Riverdene North	3,700	...	98.0	44.0	86.1	59.0	72.6	...	62.7	67	1.30	+0.2	7
Stapleford ...	5,450	...	86.0	34.0	74.8	54.6	64.7	...	58.1	61	2.35	+1.0	8
Umtali	3,677	894.8	95.0	49.0	83.9	60.5	72.2	+1.3	62.0	55	0.66	−0.5	5
Victoria ...	3,570	897.8	95.0	41.0	83.6	59.9	71.8	+0.5	...	...	1.26	+0.2	6
Melsetter ...	5,060	852.4	89.0	47.0	78.4	57.6	68.0	..	58.0	47	0.22	−1.2	4
Mount Selinda	3,520	...	96.0	47.0	79.6	60.3	69.9	...	61.4	68	1.24	−0.7	8

Notes from the "Gazette."

"*Gazette*" *Date.*	*Items.*
	DAIRY INDUSTRY CONTROL ACT, 1931.
23.10.31.	Government Notice No. 639 proclaims the following:—Any person when selling farm butter other than in a package wrapped in butter paper and containing one pound of butter shall keep an accurate record of the quantity of butter so sold to each purchaser on every separate occasion, the name and address of every such purchaser and the date of every such sale, and shall transmit to the Dairy Industry Control Board before the fifteenth of every calendar month a copy of the record aforesaid, together with a sum equal to the levy imposed on farm butter in respect of all farm butter sold as aforesaid during the preceding calendar month.
6.11.31.	Government Notice No. 678 contains regulations providing for the branding and de-grading of creamery butter. Four grades apply to the qualities of creamery butter, viz., first grade, second grade, third grade and cooking.
	POUND.
30.10.31.	The pound at Macheke has been abolished. As from 1st November, 1931, a pound has been established on Mount Anwa Farm, in the Marandellas' native district.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution at 3d. per copy. Application should be made to the Editor, Department of Agriculture, Salisbury, and remittances must accompany orders.

AGRICULTURE AND CROPS.

No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
No. 374. Fibre Crops—Deccan Hemp (Hibiscus Cannabinus) and Sunn Hemp (Crotolaria Juncea), by J. A. T. Walters, B.A.
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
No. 510. Check-row Planting of Maize, by H. G. Mundy, F.L.S.
No. 513. The Carob Bean in Rhodesia, by J. A. T. Walters, B.A.
No. 545. Artificial or Synthetic Farmyard Manure, by H. G. Mundy, Dip.Agric., F.L.S.
No. 550. Onion Growing under Irrigation, by C. Mainwaring.
No. 561. Wheat Growing in Rhodesia, by C. Mainwaring.
No. 568. The Treatment of Arable Land, by G. N. Blackshaw, O.B.E, B.Sc., F.I.C.
No. 590. Rye, by H. W. Hilliard, Junior Agriculturist.
No. 598. Drought-resistant and Early-maturing Crops for Areas of Late Rainfall, by C. Mainwaring.
No. 599. Rhodesian Soils and their Treatment, by E. V. Flack.
No. 603. The Production of Maize in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 630. The Storage of Seed Potatoes, by H. C. Arnold.
No. 634. Barley, by P. V. Samuels.
No. 643. Noxious Weeds in Southern Rhodesia, by F. Eyles, Botanist.
No. 650. Coffee Culture in Southern Rhodesia, by G. W. Marshall, Horticulturist.
No. 651. Two Important Leguminous Crops: The Velvet Bean and Dolichos Bean, by C. Mainwaring, Agriculturist.
No. 656. Tractor Notes, by A. W. V. Crawley, M.E., F.G.S.
No. 657. Hay-making in Southern Rhodesia, by C. Mainwaring, Agriculturist.
No. 663. The Use of Fertilisers and Manures in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.
No. 672. Hay-making in Rhodesia, by H. G. Mundy, Dip.Agric., F.L.S.
No. 674. Top Dressing of Maize against Stalk Borer, by H. C. Arnold.
No. 681. The Sunflower (Helianthus Annuus) (Revised), by S. D. Timson, M.C., Dip.Agric.
No. 685. Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.
No. 694. The Edible Canna (Canna Edulis), by D. E. McLoughlin.
No. 695. The Castor Oil Plant (Ricinus spp.), by S. D. Timson, M.C., Dip.Agric.
No. 697. Results of Analysis of Samples taken under the "Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance" during the year 1927-28.
No. 700. Further Notes on Farm Practice at the Government Farm, Gwebi, by S. D. Timson, M.C., Dip.Agric.

No. 704. The Importance of Research on Pasture Improvement in Southern Rhodesia, by A. D. Husband, A.I.C., Chief Chemist.

No. 705. Suggested Cropping Programmes for Farms on the Sand Veld, by D. E. McLoughlin, Assistant Agriculturist.

No. 706. A Farmers' Calendar of Crop Sowings, by C. Mainwaring, Agriculturist.

No. 708. Witch Weed or Rooibloem (Striga Lutea)—a Serious Menace to Maize, by J. A. T. Walters, B.A., F.R.S.A., Agriculturist.

No. 709. Sand Veld Farming and its Possibilities, by E. D. Alvord, M.Sc. (Agr.).

No. 710. Monthly Reminders for the Farming Year, by the Division of the Chief Agriculturist.

No. 713. Ensilage, by J. A. T. Walters, B.A., Agriculturist.

No. 724. Ploughing by Tractor, by A. W. V. Crawley, M.E., F.G.S.

No. 727. Farmyard Manure, by A. P. Taylor, M.A., B.Sc., Agricultural Chemist.

No. 732. Two Common Diseases of Potato Tubers in Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

No. 743. Sunn Hemp, by S. D. Timson, M.C., Dip.Agric.

No. 751. The Sweet Potato, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 757. Maize on the Sand Veld : Results at the Tobacco Experiment Station, Salisbury, by C. A. Kelsey-Harvey, Manager.

No. 758. Instructions for Taking Soil Samples. Issued by the Division of Chemistry.

No. 759. Witch Weed (Striga Lutea) : Methods of Control, by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 762. The Value of Rock Phosphate and "Bone and Superphosphate" as Fertilisers for Maize Production, by A. D. Husband, Chief Chemist.

No. 768. The Ground Nut (Arachis hypogaea), by S. D. Timson, M.C., Dip.Agric. (Wye).

No. 775. Agricultural Costings at the Gwebi Farm, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 776. Regulations Governing the Export of Maize and Maize Meal through the Port of Beira.

No. 777. Some Aspects of Cost of Production Studies in Agriculture, by Arthur G. Ruston, D.Sc., Department of Agriculture, Leeds University.

No. 781. Agricultural Costings at the Gwebi Farm—Maize and Green Manuring, by H. G. Mundy, Dip.Agric., F.L.S., Chief Agriculturist, and J. Hick, Accountant.

No. 783. Agricultural Costings at the Gwebi Farm—Fattening for Beef, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 787. Agricultural Costings at the Gwebi Farm—Ground Nuts and Maize and Beans for Silage, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 793. Agricultural Costings on the Gwebi Farm, by H. G. Mundy, Dip.Agric., Chief Agriculturist.

No. 797. Green Manuring: An Essential Practice in Rhodesian Farming, by H. G. Mundy, Dip.Agric. (Wye), F.L.S., Chief Agriculturist.

No. 802. Witch Weed, by S. D. Timson, M.C., Inter.B.Sc. (Agric.) Lond., Dip.Agric. (Wye), Assistant Agriculturist.

No. 807. Studies on the Improvement of Natural Veld Pastures: No. 2, by A. D. Husband, F.I.C., and A. P. Taylor, M.A., B.Sc., Chemistry Branch, Department of Agriculture.

No. 813. A Preliminary Note on Clovers in Southern Rhodesia, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.
No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.
No. 816. Preliminary List of the more Common Grasses of Southern Rhodesia, by Sydney M. Stent, Botanist for Pasture Research.
No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.
No. 823. The Law of Supply and Demand—No. 2, by J. R. McLoughlin, M.Sc. (Economics), Economic Adviser.
No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.
No. 831. Revised Notes on Cotton Growing in Southern Rhodesia, by G. S. Cameron.
No. 833. Subterreanean Clover on the Sand Veld as Feed for Poultry in the Winter, by S. D. Timson, M.C., Dip.Agric.(Wye).
No. 836. The Potato, by S. D. Timson, M.C., Dip.Agric.(Wye).
Botanical Specimens for Identification.
Accelerating the Sprouting of Potatoes.

REPORTS ON CROP EXPERIMENTS.

No. 94. Second Report on Experiments, by J. H. Hampton.
No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
No. 239. Reports on Crop Experiments, Gwebi, 1915-16, Part I., by E. A. Nobbs, Ph.D., B.Sc.
No. 246. Report on Crop Experiments, Gwebi Farm, Season 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
No. 342. Rotation Experiments, 1913-19, by H. G. Mundy, F.L.S., and J. A. T. Walters, B.A.
No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-20.
No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.
No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.
No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.
No. 437. Annual Report of Crop Experiments, Gwebi Experiment Farm, 1921-22, by H. G. Mundy, F.L.S.
No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
No. 485. Annual Report of Experiments, 1922-23, Agricultural Experiment Station, Salisbury, by J. A. T. Walters, B.A.
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No. 514. Bulawayo Experiment Station Report, 1923-24, by H. G. Mundy, F.L.S.
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